Liebert® MC™

60-Hz Air-cooled Microchannel Condenser - Premium/EC Fan

Installer/User Guide

Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures. Visit https://www.VertivCo.com/en-us/support/ for additional assistance.

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IMPORTANT SAFETY GUIDELINES

Save These Instructions

This manual contains important safety instructions that should be followed during the installation and maintenance of the Liebert MC. Read this manual thoroughly before attempting to install or operate this unit.

Only qualified personnel should move, install or service this equipment.

Adhere to all warnings, cautions and installation, operating and safety instructions on the unit and in this manual. Follow all operating and user instructions.

WARNING! Risk of improper handling, installation and service. Can cause property damage, injury or death.

Only properly trained and qualified personnel should install or perform repairs or maintenance on this unit. Read all installation, operation and safety alerts and instructions and wear appropriate protective headgear, safety glasses, gloves and clothing before installing, operating or servicing this unit.

WARNING! Arc flash and electric shock hazard. Open all local and remote electric power disconnect switches, verify with a voltmeter that power is Off and wear personal protective equipment per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death.

Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The LiebertiCOM® microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of LiebertiCOM control.

The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.
Follow all local codes.

WARNING! Risk of contact with high-speed, rotating fan blades. Can cause serious personal injury or death.

Fan blades can automatically start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Open all local and remote electric power supply disconnect switches, wait 10 minutes and verify with a voltmeter that power is Off before working within the unit cabinet, removing the fan guards or servicing the fan speed control, fan blades or EC fan motors.

WARNING! Risk of electrical fire and short circuit. Can cause property damage, injury or death.

Select and install the line side electrical supply wire and overcurrent protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state and local code requirements. Use copper conductors only.

Verify that all electrical connections are tight. Unit-specific wiring diagrams are provided on each unit.

WARNING! Risk of electric shock. Can cause injury or death.

The fan speed control and the EC fan electrical enclosures may contain a stored electrical charge. Open all local and remote electric power disconnect switches, verify with a voltmeter that power is Off and wait 10 minutes before working within the fan speed control and the EC fan electrical enclosures.

WARNING! Risk of heavy condenser falling or tipping over. Can cause property damage, serious injury or death.

Confirm that all components of the lifting system are rated for the weight of the condenser by an OSHA Certified rating organization before attempting to lift and/or move the condenser. See 2.2 on page 15 throughCondenser and option net weights—Large condensers on page 17 for the condenser weights.

CAUTION: Risk of contact with hot surfaces. Can cause injury.

Fan motors, transformers, piping and other components may become extremely hot during normal operation. Wear thermally insulated gloves and appropriate protective clothing and allow time for components to cool when working within the cabinet or electric control enclosure.

CAUTION: Risk of contact with sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift, remove packaging from or prepare unit for installation.

CAUTION: Risk of explosive discharge of high-pressure gas. Can cause injury.

Relieve system pressure and verify that the indoor and outdoor units are Off before making piping connections/disconnections.

Do not exceed the design pressure rating that is marked on the nameplate.

Do not install a shutoff valve between the compressor and the field-installed pressure relief valve.

NOTICE

Risk of interference with building doorways, openings and passages. Can cause unit and/or building damage.

Refer to the installation plans and measure the unit and building opening before moving the unit to verify clearances.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep unit upright and protected from contact damage.

NOTICE

Risk of improper forklift handling. Can cause unit damage.

Keep the forklift tines level and at a height that will fit under the skid.

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R-407C and R-410A are blended refrigerants and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor.

Vertiv™ recommends connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjusting the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

NOTICE

Risk of refrigerant overcharge. Can cause equipment damage.

Do not use the sight glass as an indicator when charging Liebert MC condenser systems.

NOTICE

Risk of using damaging cleaning agents, including non-base paint solvents. Can cause equipment damage and damage to property and loss of refrigerant charge.

Using acid-based or sodium hydroxide-based cleaners can damage the Liebert MC condenser coil and cause a loss of charge. This could cause equipment damage as well as damage to the surrounding structure.

LIEBERT MC NOMENCLATURE

Model Number – Part 1/2										Model Details											Part 2/2			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
M	C	M	0	4	0	E	1	A	D	0	A	0	V	U	0	0	0	0	0	0	*	*	*	*

1-2. Unit Family; MC = Liebert® MC™	**11. Coil Coating**
3. Platform Size	0 = None
S = Small	E = E-Coat (Epoxy)
M = Medium	**12. Panel Material**
L = Large	A = Bright Aluminum
4-6. Nominal Condenser Capacity, kW	**13. Connection Pipe Unit of Measurement**
028, 056, 040, 055, 080, 110, 160, 165, 220 Example: 040 = 40kW @ 95°F(35°C) & 27°R (15°K) ITD	0 = Inches (Std. ACR Copper)
	14. Legs Included
7. Control/Fan Type	V = 18" Tall Legs (Std.)
E = Premium & EC Fan	X = 36" Tall Legs with Bracing
8. Refrigerant Circuits/System Refrigerant type	Y = 48" Tall Legs with Bracing
1 = Single Refrigerant Circuit, R-410A	Z = 60" Tall Legs with Bracing
2 = Dual Refrigerant Circuit, R-410A	**15. Agency Certification**
7 = Single Refrigerant Circuit, R-407C, R-22	U = CSA Listed, Marked with CSA c-us logo
8 = Dual Refrigerant Circuit, R-407C, R-22	1 = IBC/OSHPD Seismic Certification, IBC/FBC Wind Load Certification and IBC Snow Load Certification.
9. Power Supply	**16. Undefined - Reserved for Future Use**
A = 460V / 3ph/60Hz	**17. Liebert Lee-Temp™ Configuration**
B = 575V / 3ph/60Hz	0 = No Receiver Leg/Software
Y = 208/230V/3ph/60Hz	1 = Liebert Lee-Temp Receiver Leg/Software
2 = 380V/3ph/60Hz	2 = Liebert DSE Receiver Leg/Software
10. Packaging	**18-21. Undefined - Reserved For Future Use**
D = Domestic, Non-Stackable (Horizontal Airflow Orientation)	**22-25. Factory Configuration Number**
E = Export Crating - Non-Stackable (Horizontal Airflow Orientation)	

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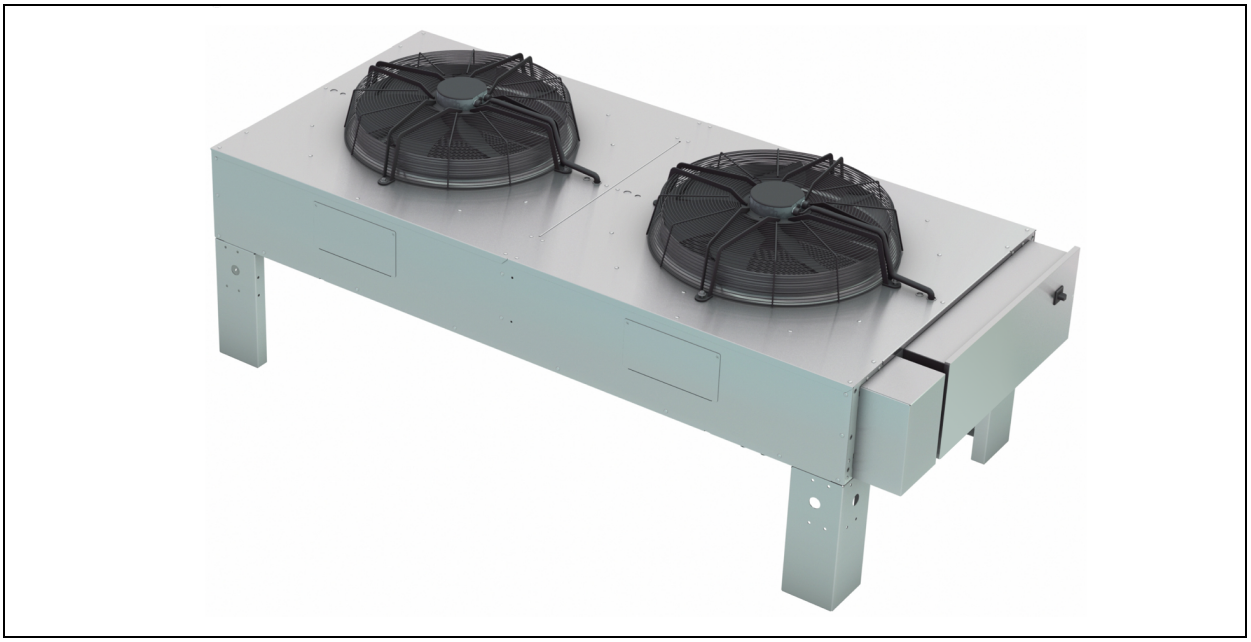
1 INTRODUCTION

1.1 Product Description and Features

The Liebert MC condenser is a low-profile, direct-drive propeller fan-type air-cooled unit suitable for mounting outdoors. It provides heat rejection for either one or two separate refrigeration circuits, matches the heat rejection capacity corresponding with the outdoor ambient temperature and with each corresponding compressor heat rejection requirements. Constructed with an aluminum cabinet, galvanized steel frame and microchannel coil, the unit is quiet and corrosion resistant. The condenser is quickly and easily installed, because all internal wiring is completed at the factory with only electrical connections to be made at the job site. All electrical connections and controls are enclosed in an integral weatherproof section of the condenser.

Figure 1.1 Two-fan Liebert MC



1.2 Control, Fan Types and Features

1.2.1 Premium Efficiency Control/EC Fan

Premium Efficiency Controls and EC fans are matched to provide superior system energy efficiency. The premium control board allows CANbus communication with the indoor unit's Liebert iCOM® control. This communication feature provides compressor run signals, condenser operating mode changes, condenser alarm monitoring, simplified system charging procedures and outdoor temperature monitoring. The fans are controlled by the premium control board using pressure transducer signals from the refrigerant circuit and factory programming to control the refrigerant head pressure.

The Premium Efficiency Control board on a Liebert MC with a dual refrigeration circuit adjusts the speed of fans on each circuit to match each circuit's head pressure conditions. On a Liebert MC with multiple fans and a single refrigeration circuit, the premium control adjusts the fans to the same speed to maintain head pressure. The control system provides refrigerant head pressure control for outdoor ambient temperatures as low as -30°F (-35°C), provided that the total design range (from minimum to maximum) is 125°F (70°C) or less. For traditional DX applications, Liebert Lee-Temp™ kits are required only when the design temperature ranges exceed 125°F (70°C) for standard match-ups and 115°F (65°C) for Liebert Quiet-Line™ match-ups.

Anti-Freezing Operation

The EC fans must be operated periodically in cold weather to reduce the possibility of lockup due to ice and snow accumulation. During periods of inactivity and outdoor temperatures below 35°F (1.6°C), the EC fans will spin for at least 30 seconds every 15 minutes at 60% of the maximum fan speed.

Fan Reversal for Cleaning

The Liebert iCOM® can be used to run the Premium EC fans in reverse to clear loose debris from the coil between scheduled coil cleanings. The fan reversal may be done manually or automatically based on a user-programmed schedule. Automatic fan reversal interval occurs when the indoor unit is Off (BMS Off, U2U network standby or Remote Shut Down [RSD]).

Low-Noise Feature

The low-noise feature allows setting the condenser fans to operate at a specified speed to reduce operating noise at certain times. Special match-ups of premium condensers are available for applications needing to meet stringent sound regulations. Lower sound levels are achieved by oversizing the condenser, which decreases the maximum airflow and sound level produced by the condenser. This feature requires special setup of the indoor unit. One or more Liebert Lee-Temp receivers are required. The premium control has gain schedules that will override the user-defined low-noise schedule to prevent a high-pressure condition from occurring.

1.3 Liebert Lee-Temp™ Refrigerant Control

The Liebert Lee-Temp head pressure control system utilizes head pressure control valve(s), extra refrigerant and insulated refrigerant receiver(s) with heater pads to assist system starting. The Liebert Lee-Temp control system also maintains proper operating head pressures in outdoor temperatures below the rating point of the Liebert MC control type. The system works by flooding the condenser coil with liquid refrigerant to a level that balances the system condensing requirements with the condenser coil surface available to reject the system heat. During the summer, the system requires the entire condenser coil surface for heat rejection and most of the refrigerant is stored in the receiver. In the winter, the same amount of heat can be rejected by only a fraction of the coil surface. As head pressure begins to fall, the control valve restricts the flow of liquid refrigerant from the condenser. This extra liquid refrigerant reduces the effective condenser surface area available for heat transfer. The head pressure control valve also bypasses hot gas into the receiver to warm the liquid and maintain liquid pressure for proper operation of the expansion valve. Liebert Lee-Temp kit is optional for condensers and is field-installed. Condenser control boards are factory-configured for Liebert Lee-Temp if they are ordered with Liebert Lee-Temp receivers. They can be field-configured if a Liebert Lee-Temp system is added later.

1.4 Surge Protective Device

An optional Surge Protective Device (SPD) can be field-wired to protect the condenser from power surges that threaten sensitive equipment. The condenser's electrical panel provides a terminal block to allow the SPD to be wired in parallel with the high-voltage power. An additional low-voltage terminal block is provided on condensers with Premium Control Boards to allow monitoring of the SPD alarm circuit.

ASCO 420™ Series surge protective device provides 50kA per mode of surge current protection. An illuminated green LED indicates the SPD is On and operating properly. An illuminated red LED indicates that the device may require replacement.

When both LEDs are Off, there is no power to the condenser, either from a power failure or because the condenser disconnect is in the Off position.

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2 SITE PREPARATION

2.1 Site Considerations

- Condensers should be installed in a location offering maximum security and access for maintenance.
- Avoid ground-level sites with public access and areas prone to heavy snow or ice accumulations.
- To ensure adequate air supply, Vertiv™ recommends that condensers be installed in an area with clean air, away from loose dirt and foreign matter that might clog the coil. In addition, condensers should be located no closer than 3 feet (1m) from a wall, obstruction or adjacent unit.
- For roof installation, mount the condenser on suitable curbs or other supports in accordance with local codes.
- Condensers must not be installed in a pit.
- Condensers must be installed on a level surface to ensure proper refrigerant flow.
- Use caution when installing condensers below the indoor unit. Condensers must not be installed more than 15ft. (4.6m) below the indoor unit. Condensers with Liebert Lee-Temp™ receivers must be installed at or above the level of the indoor units to maintain proper subcooling.
- Liebert Lee-Temp receiver tanks should be mounted on the condenser legs for proper operation. Contact Vertiv™ Application Engineering Department for assistance with applications requiring remote mounting of receivers.
- Condensers must be installed in vertical airflow orientation to maintain the electrical box's NEMA 3R rating.

2.2 Dimensions and Weights

Table 2.1 Condenser shipping weights, dimensions and volume, approximate

Model #	Number of Fans	Domestic Packaging			Export Packaging		
		Weight lb (kg)	Dimensions (L x W x H) in. (cm)	Volume ft^3 (m^3)	Weight lb (kg)	Dimensions (L x W x H) in. (cm)	Volume ft^3 (m^3)
MCS028	1	359 (163)	76 x 36 x 63 (193 x 91 x 160)	100 (2.8)	476 (216)	77 x 37 x 64 (196 x 94 x 163)	106 (3.0)
MCS056	2	562 (255)	122 x 36 x 63 (310 x 91 x 160)	160 (4.5)	734 (333)	123 x 37 x 64 (312 x 94 x 163)	161 (4.8)
MCM040	1	439 (199)	76 x 36 x 63 (193 x 91 x 160)	100 (2.8)	556 (252)	77 x 37 x 64 (196 x 94 x 163)	106 (3.0)
MCM080	2	769 (349)	122 x 36 x 63 (310 x 91 x 160)	160 (4.5)	941 (427)	123 x 37 x 64 (312 x 94 x 163)	161 (4.8)
MCM160	4	1509 (684)	256 x 36 x 63 (650 x 91 x 160)	336 (9.5)	1834 (832)	257 x 37 x 64 (653 x 94 x 163)	352 (10)
MCL055	1	552 (250)	76 x 36 x 63 (193 x 91 x 160)	100 (2.8)	669 (303)	77 x 37 x 64 (196 x 94 x 163)	106 (3.0)
MCL110	2	962 (436)	136 x 36 x 63 (345 x 91 x 160)	179 (5.0)	1134 (514)	137 x 37 x 64 (348 x 94 x 163)	188 (5.3)

Table 2.1 Condenser shipping weights, dimensions and volume, approximate (continued)

Model #	Number of Fans	Domestic Packaging			Export Packaging		
		Weight lb (kg)	Dimensions (L x W x H) in. (cm)	Volume ft^3 (m^3)	Weight lb (kg)	Dimensions (L x W x H) in. (cm)	Volume ft^3 (m^3)
MCL165	3	1364 (619)	196 x 36 x 63 (498 x 91 x 160)	257 (7.3)	1619 (734)	197 x 37 x 64 (500 x 94 x 163)	270 (7.7)
MCL220	4	1835 (832)	256 x 36 x 63 (650 x 91 x 160)	336 (9.5)	2160 (980)	257 x 37 x 64 (653 x 94 x 163)	352 (10)

1. Packaged weights will increase with factory options, such as legs taller than 18" (457mm), coated coils, 575V and seismic/wind options. See Table 2.2 below, Table 2.3 below and Table 2.4 on the facing page for option weights to add to the packaged weights above. Consult factory for additional information.
2. Receivers and 60" legs are shipped separately from the condenser.

2.2.1 Condenser and Options Net Weights

Total unit weight is the sum of the condenser weight with the selected legs plus the weight of any option.

Source: DPN003034, Rev. 1

Table 2.2 Condenser and option net weights—Small condensers

Condenser Model		MCS028	MCS056
Refrigeration Circuits		1	2
Condenser Dry Weight, lb (kg)	18" Leg	154 (70)	270 (122)
	36" Leg	286 (130)	419 (190)
	48" Leg	318 (144)	451 (205)
	60" Leg	349 (158)	482 (219)
Additional Weight for Options, lb (kg)			
Liebert Lee-Temp		55 (25)	110 (50)
Coated Coil		4 (2)	8 (4)
575V		52 (24)	63 (29)
Seismic/Wind Bracing, 18-in. legs		40 (18)	40 (18)

Table 2.3 Condenser and option net weights—Medium condensers

Condenser Model		MCM040	MCM080		MCM160
Refrigeration Circuits		1	1	2	2
Condenser Dry Weight, lb (kg)	18" Leg	231 (105)	441 (200)	441 (200)	860 (390)
	36" Leg	363 (165)	590 (268)	590 (268)	1066 (484)
	48" Leg	395 (179)	622 (282)	622 (282)	1114 (505)
	60" Leg	426 (193)	653 (296)	653 (296)	1160 (526)

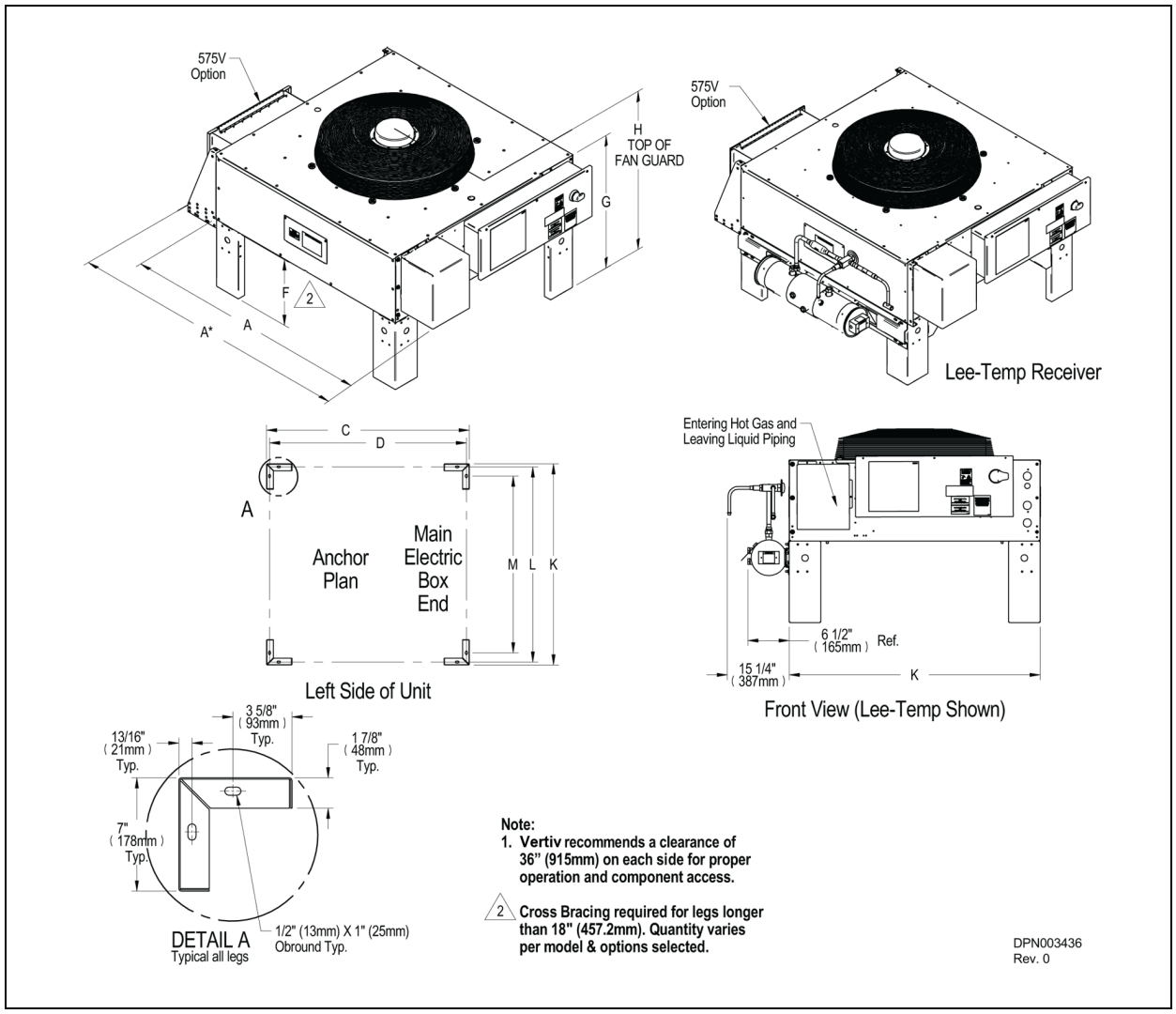
Table 2.3 Condenser and option net weights—Medium condensers (continued)

Condenser Model	MCM040	MCM080		MCM160
Refrigeration Circuits	1	1	2	2
Additional Weight for Options, lb (kg)				
Liebert Lee-Temp	55 (25)	100 (45)	110 (50)	220 (100)
Liebert DSE Receiver DA050	—	44 (20)	—	—
Liebert DSE Receiver DA080/085	—	—	—	88 (40)
Liebert DSE Receiver DA125/150/165	—	—	—	184 (83)
Coated Coil	5 (2)	10 (5)	10 (5)	20 (9)
575V	52 (24)	63 (29)	63 (29)	76 (34)
Seismic/Wind Bracing, 18-in. legs	40 (18)	40 (18)	40 (18)	57 (26)

Table 2.4 Condenser and option net weights—Large condensers

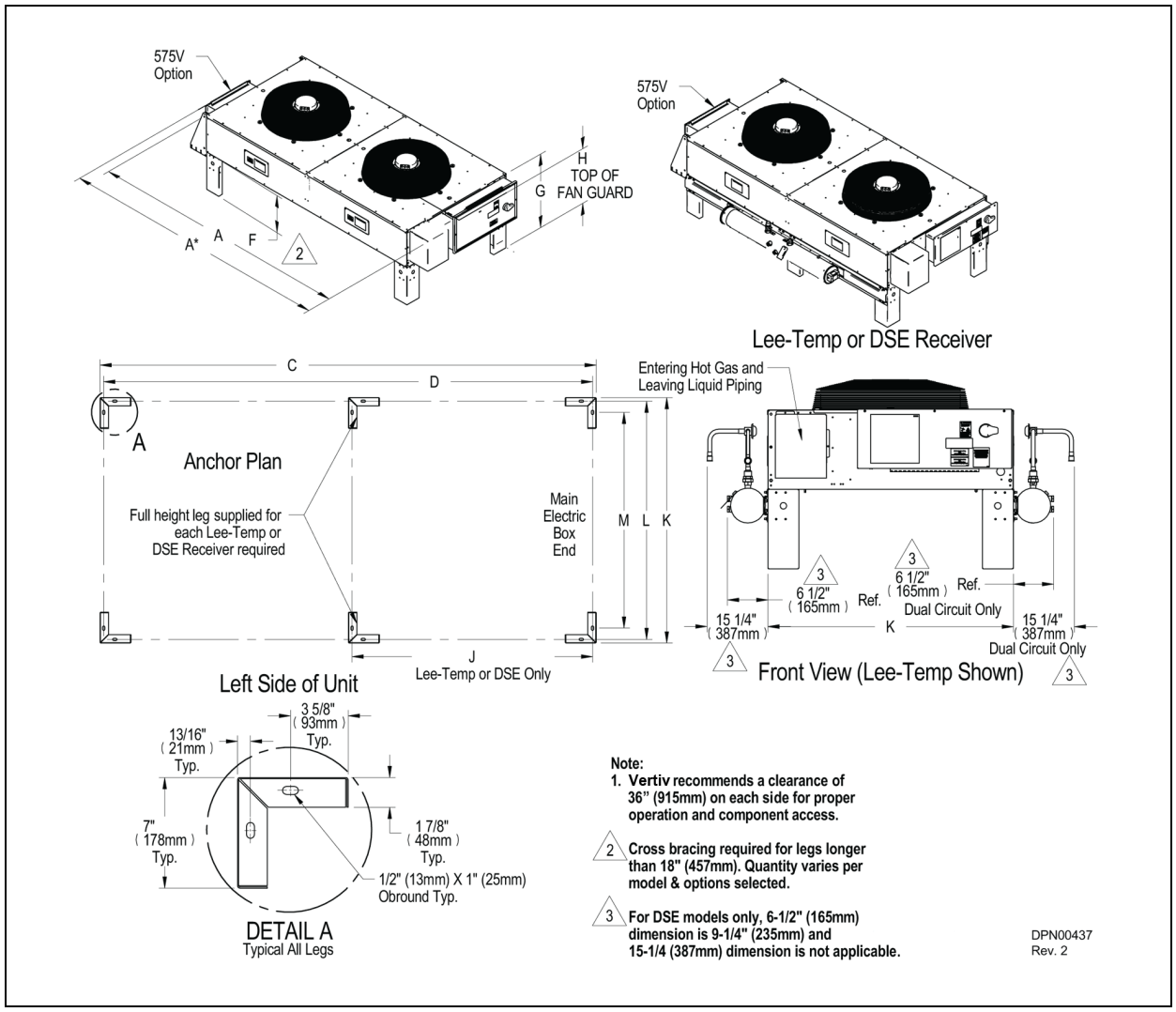
Condenser Model		MCL055	MCL110		MCL165	MCL220	
Refrigeration Circuits		1	1	2	1	1	2
Condenser Dry Weight, lb (kg)	18" Leg	344 (156)	602 (273)	602 (273)	891 (404)	1186 (538)	1186 (538)
	36" Leg	486 (220)	766 (347)	766 (347)	1136 (515)	1453 (659)	1453 (659)
	48" Leg	518 (235)	798 (362)	798 (362)	1184 (537)	1501 (681)	1501 (681)
	60" Leg	549 (249)	829 (376)	829 (376)	1230 (558)	1547 (702)	1547 (702)
Additional Weight for Options, lb (kg)							
Liebert Lee-Temp		60 (27)	115 (52)	120 (54)	175 (79)	215 (98)	240 (109)
Liebert DSE Receiver DA050		—	45 (20)	—	45 (20)	—	—
Liebert DSE Receiver DA080/085		—	45 (20)	90 (41)	—	45 (20)	90 (41)
Liebert DSE Receiver DA125/150/165		—	94 (43)	188 (85)	94 (43)	94 (43)	188 (85)
Coated Coil		8 (4)	16 (7)	16 (7)	24 (11)	32 (15)	32 (15)
575V		79 (36)	90 (41)	90 (41)	132 (60)	134 (61)	134 (61)
Seismic/Wind Bracing, 18-in. legs		40 (18)	40 (18)	40 (18)	57 (26)	57 (26)	57 (26)

Figure 2.1 Condenser planning dimensional data—MCS028, MCM040 and MCL055



Liebert Model No.	Cabinet Dimensions in. (mm)						
	A	A* (575V only)	C	D	K	L	M
MCS028	50-5/8 (1287)	58-7/8 (1495)	44-1/8 (1120)	42-1/2 (1080)	42-1/2 (1080)	40-7/8 (1038)	35-7/8 (910)
MCM040	57-3/16 (1453)	65-3/8 (1661)	48 (1219)	46-5/16 (1177)	46 (1168)	44-3/8 (1127)	39-5/16 (999)
MCL055	68 (1727)	77 (1956)	56 (1422)	54-3/8 (1381)	55-1/2 (1410)	53-78 (1368)	48-3/4 (1238)
Leg-height Dimensions in. (mm)							
All Models	F	18 (457)	36 (914)	48 (1219)	60 (1524)	--	--
MCS028 MCM040	G	31-5/8 (803)	49-5/8 (1260)	61-5/8 (1565)	73-5/8 (1870)	--	--
	H	39-5/8 (1006)	57-5/8 (1464)	69-5/8 (1768)	81-5/8 (2073)	--	--
MCL055	G	35-7/8 (911)	53-7/8 (1368)	65-7/8 (1673)	77-7/8 (1978)	--	--
	H	43-5/8 (1108)	61-5/8 (1565)	73-5/8 (1870)	85-5/8 (2175)	--	--
Source: DPN003436, Rev. 0							

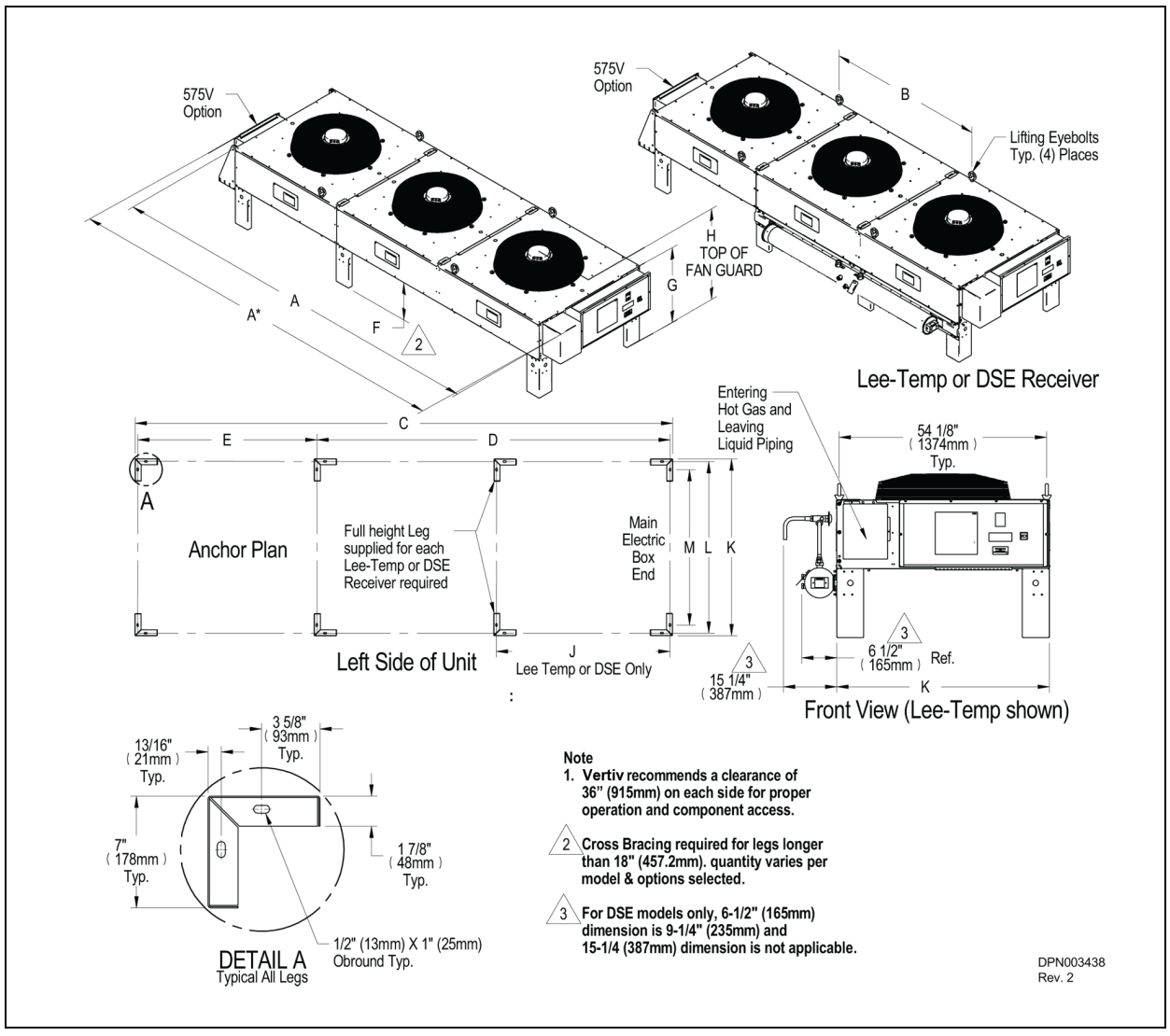
Figure 2.2 Condenser planning dimensional data—MCS056, MCM080, MCL110



Liebert Model No.	Cabinet Dimensions in. (mm)							
	A	A* (575V only)	C	D	J Lee-Temp or DSE Receivers Only	K	L	M
MCS056	94-7/8 (2411)	103-1/8 (2619)	88-3/8 (2245)	86-3/4 (2203)	42-1/2 (1079)	42-1/2 (1080)	40-7/8 (1038)	35-7/8 (910)
MCM080	105-1/4 2674)	113-7/16 (2882)	96-1/16 (2440)	94-7/16 (2398)	45-5/19 (1177)	46 (1168)	44-3/8 (1127)	39-5/16 (999)
MCL110	124-1/8 (3152)	133-1/8 (3381)	112-1/8 (2848)	110-1/2 (2806)	54-3/8 (1381)	55-1/2 (1410)	53-7/8 (1368)	48-34 (1238)
Leg-height Dimensions in. (mm)								
All Models	F	18 (457)	36 (914)	48 (1219)	60 (1524)	--	--	--
MCS056 MCM080	G	31-5/8 (803)	49-5/8 (1260)	61-5/8 (1565)	73-5/8 (1870)	--	--	--

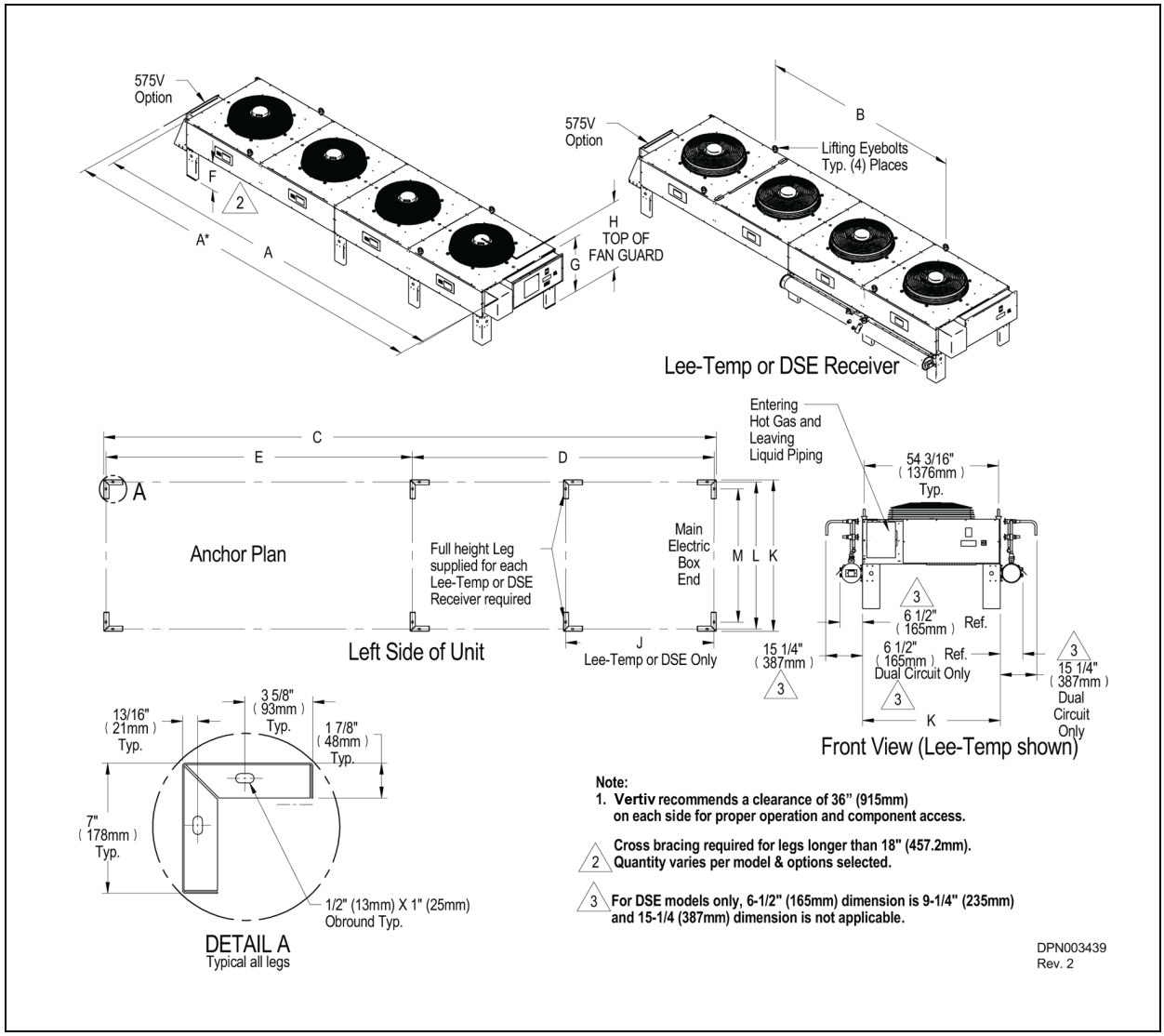
Liebert Model No.	Cabinet Dimensions in. (mm)							
	A	A* (575V only)	C	D	J Lee-Temp or DSE Receivers Only	K	L	M
	H	39-5/8 (1006)	57-5/8 (1464)	69-5/8 (1768)	81-5/8 (2073)	--	--	--
MCL110	G	35-7/8 (911)	53-7/8 (1368)	65-7/8 (1673)	77-7/8 (1978)	--	--	--
	H	43-5/8 (1108)	61-5/8 (1565)	73-5/8 (1870)	85-5/8 (2175)	--	--	--
Source: DPN003437, Rev. 2								

Figure 2.3 Condenser planning dimensional data—MCL165



Liebert Model No.	Dimensions in. (mm)									
	A	A* (57V only)	B	C	D	E	J Lee-Temp or DSE Receivers Only	K	L	M
MCL165	180-1/4 (4578)	189-1/4 (4807)	73-7/16 (1866)	168-1/4 (4274)	110-1/2 (2806)	56-1/8 (1425)	54-3/8 (1381)	55-1/2 (1410)	53-7/8 (1368)	48-3/4 (1238)
Leg-height Dimensions in. (mm)										
MCL165	F	18 (457)		36 (914)		48 (1219)		60 (1524)		--
	G	35-7/8 (911)		53-7/8 (1368)		65-7/8 (1673)		77-7/8 (1978)		--
	H	43-5/8 (1108)		61-5/8 (1565)		73-5/8 (1870)		85-5/8 (2175)		--
Source: DPN003438, Rev. 2										

Figure 2.4 Condenser planning dimensional data—MCM160 and MCL220



Liebert Model No.	Cabinet Dimensions in. (mm)									
	A	A* (575V only)	B	C	D	E	J Lee-Temp or DSE Receivers Only	K	L	M
MCM160	202-7/16 (5142)	210-5/8 (5350)	113-1/2 (2883)	192-1/4 (4883)	94-7/16 (2398)	96-3/16 (2444)	45-5/16 (1177)	46 (1168)	44-3/8 (1127)	39-5/16 (999)
MCL220	236-5/16 (6003)	245-5/16 (6231)	129-9/16 (3291)	224-3/8 (5699)	110-1/2 (2806)	112-1/4 (2851)	54-3/8 (1381)	55-1/2 (1410)	53-7/8 (1368)	48-3/4 (1238)
Leg-height Dimensions in. (mm)										
All Models	F	18 (457)		36 (914)		48 (1219)		60 (1524)		--
MCM160	G	31-5/8 (803)		49-5/8 (1260)		61-5/8 (1565)		73-5/8 (1870)		--
	H	39-5/8 (1006)		57-5/8 (1464)		69-5/8 (1768)		81-5/8 (2073)		--
MCL220	G	35-7/8 (911)		53-7/8 (1368)		65-7/8 (1673)		77-7/8 (1978)		--
	H	43-5/8 (1108)		61-5/8 (1565)		73-5/8 (1870)		85-5/8 (2175)		--
Source: DPN003439, Rev. 2										

Figure 2.5 Liebert DSE receiver mounting—MCL165 and MCL220, single-circuit condenser, left-side condenser outlet receiver

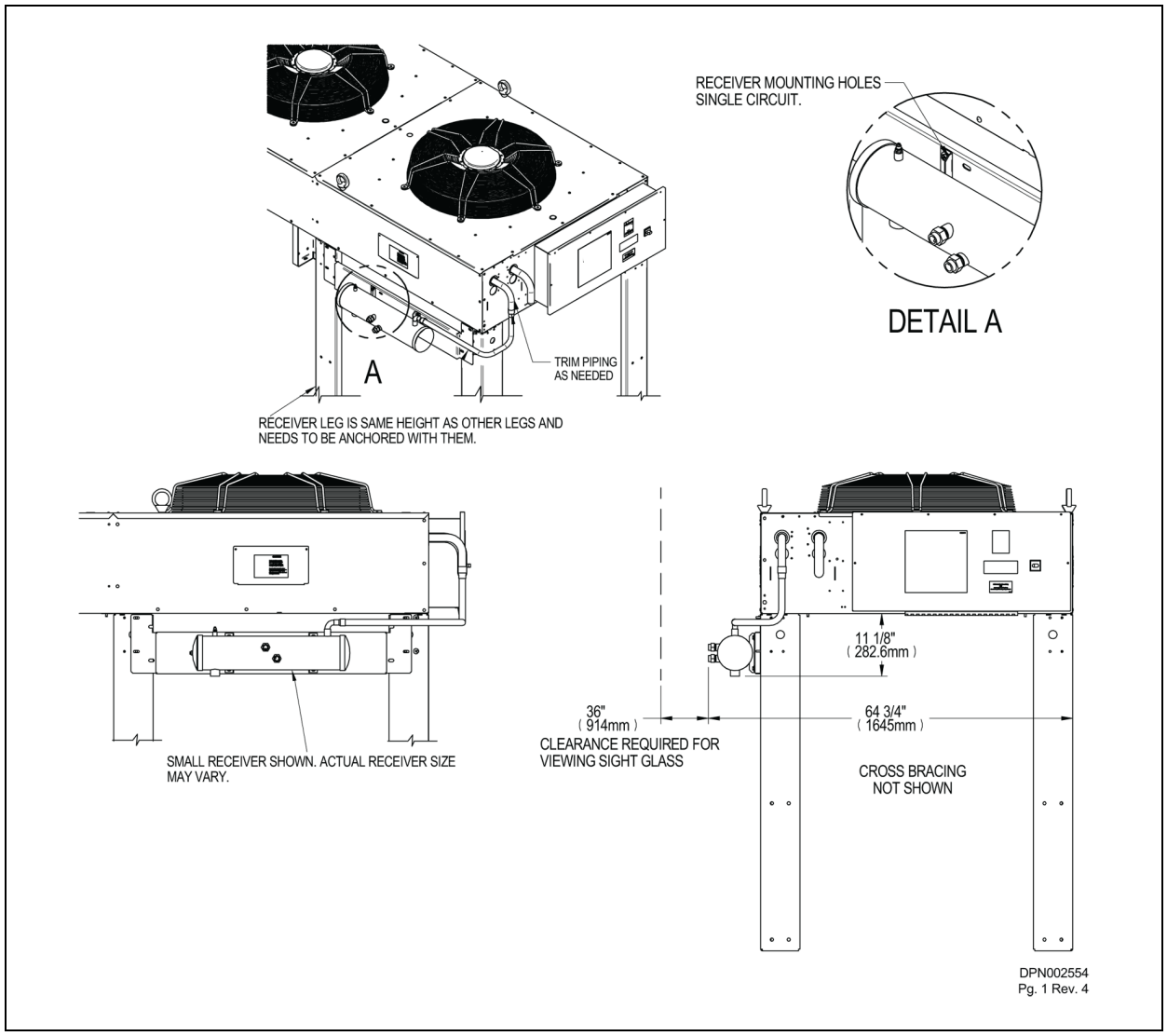


Figure 2.6 Liebert DSE receiver mounting—MCL165 and MCL220, single-circuit condenser, right-side condenser outlet receiver

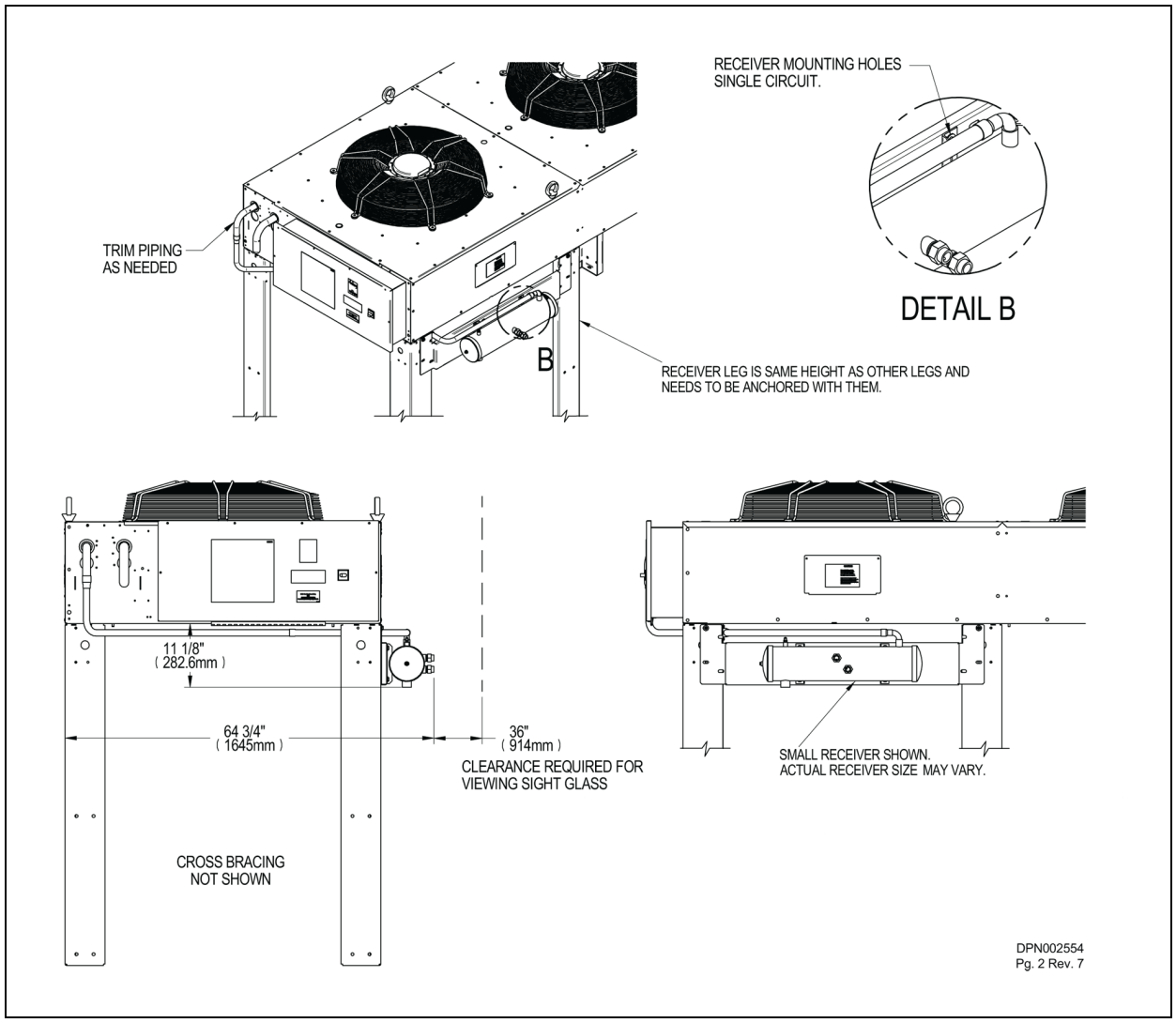


Figure 2.7 Liebert DSE receiver mounting—MCL110 and MCL220, dual-circuit condenser

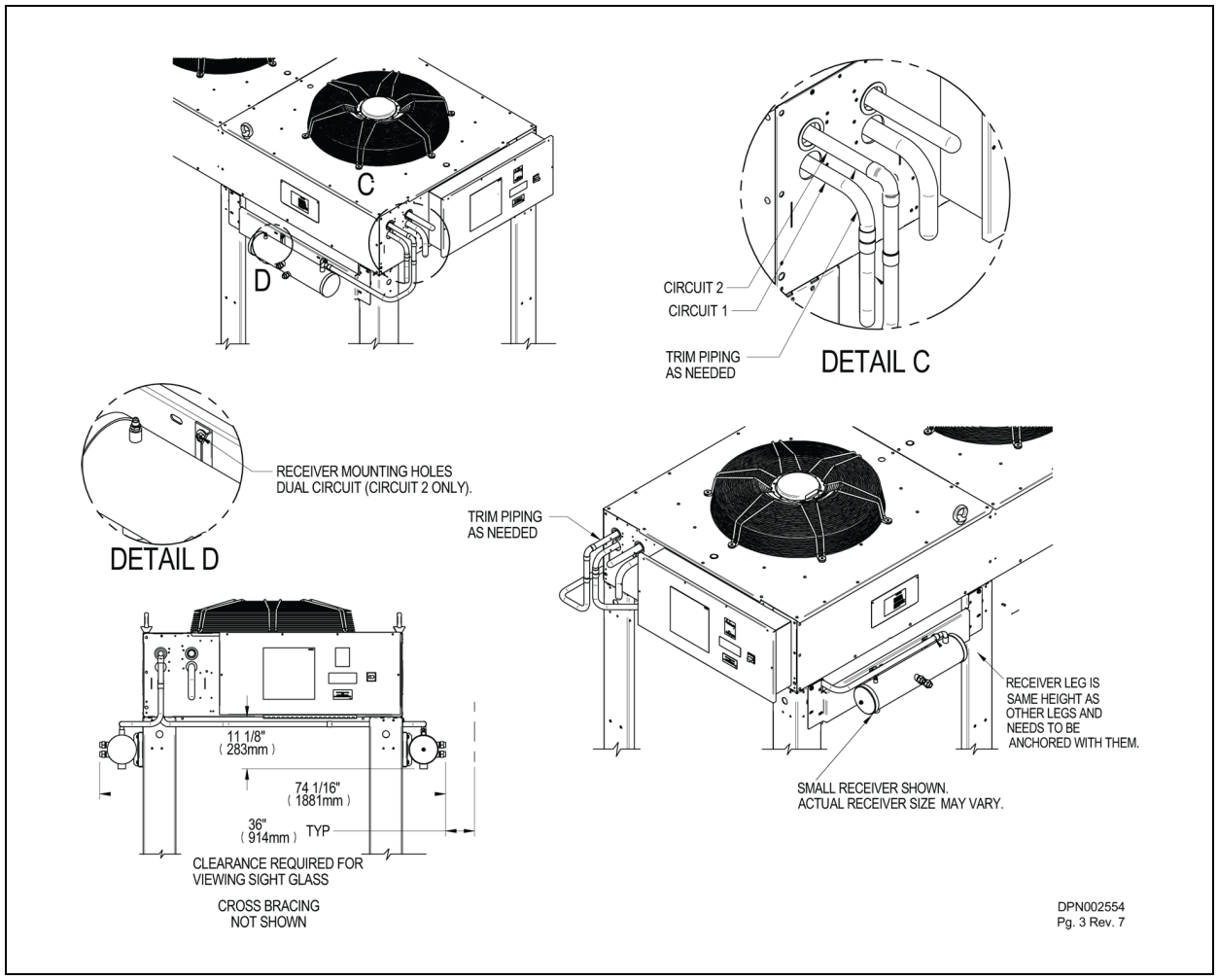
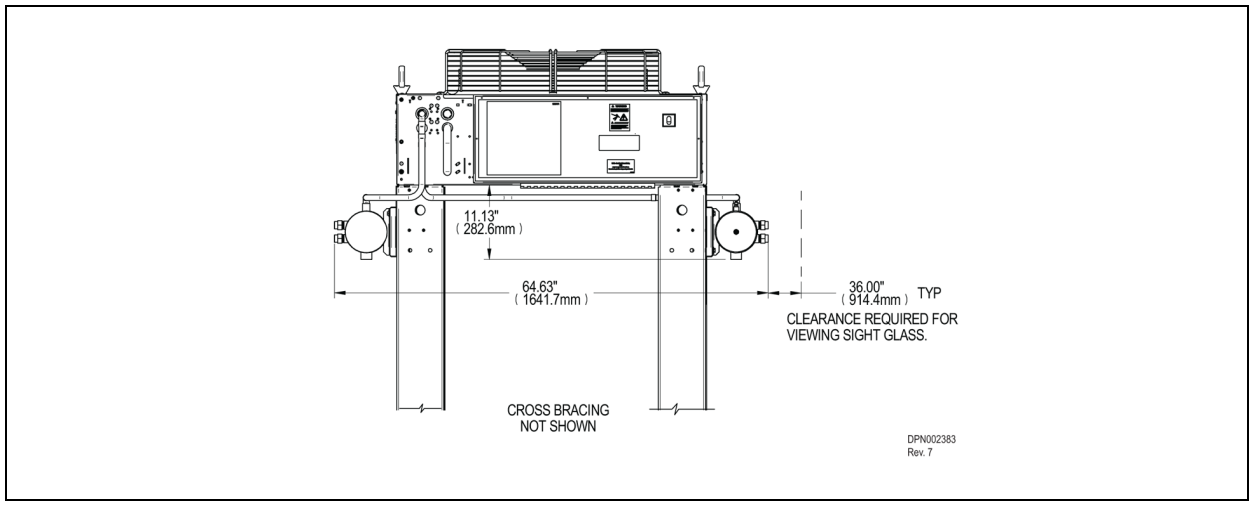


Figure 2.8 Liebert DSE receiver mounting—MCM160 dual circuit condenser



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3 INSPECTION AND INSTALLATION

Safety Information

WARNING! Risk of improper handling. Can cause equipment damage, injury or death.

Read all of the following instructions before attempting to move, lift, remove packaging from or preparing unit for installation.

WARNING! Risk of heavy condenser falling or tipping over. Can cause property damage, serious injury or death.

Confirm that all components of the lifting system are rated for the weight of the condenser by an OSHA Certified rating organization before attempting to lift and/or move the condenser. See 2.2 on page 15 through Condenser and option net weights—Large condensers on page 17 for the condenser weights.

CAUTION: Risk of contact with sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift, remove packaging from or prepare unit for installation.

NOTICE

Risk of interference with building doorways, openings and passages. Can cause unit and/or building damage.

Refer to the installation plans and measure the unit and building opening before moving the unit to verify clearances.

NOTICE

Risk of improper forklift handling. Can cause unit damage.

Keep the forklift tines level and at a height that will fit under the skid.

NOTICE

Risk of improper storage. Can cause unit damage.

Keep unit upright and protected from contact damage.

3.1 Equipment Inspection

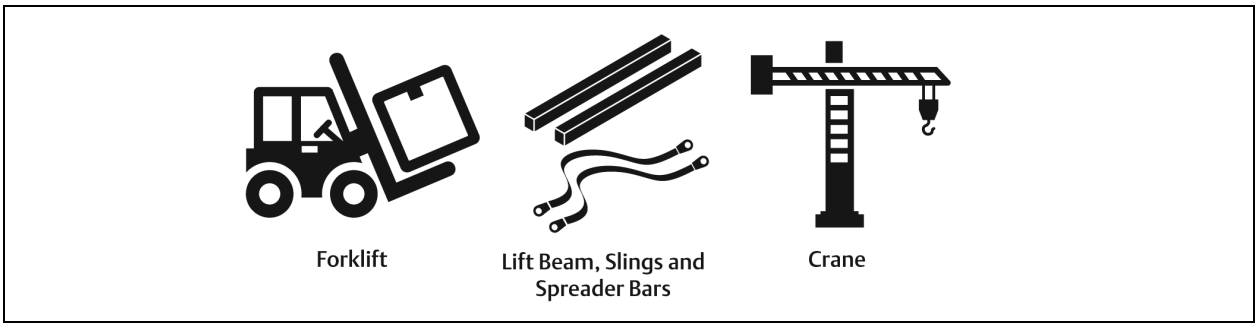
Upon arrival of the unit and before unpacking, verify that the labeled equipment matches the Bill of Lading. Carefully inspect all items for either visible or concealed damage. Damage should be immediately reported to the carrier and a damage claim filed with a copy sent to Vertiv™ or to your sales representative.

If you have the seismic mounting kit, refer to Liebert Seismic Application—Optional Unit Configuration on page 99

3.1.1 Packing Material

All material used to package this unit is recyclable. Please save it for future use or dispose of the material appropriately.

Figure 3.1 Equipment recommended for handling a Liebert condenser



3.2 Handling Unit on the Skid

Transport unit using a fork lift or a crane with sling and spreader bars.

Using a forklift

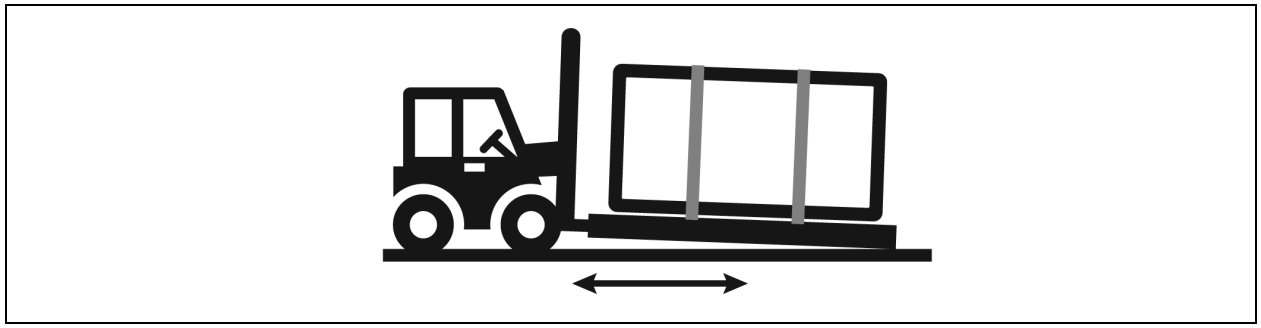
NOTICE

Risk of improper forklift handling. Can cause unit damage.

Keep the forklift tines level and at a height that will fit under the skid.

- Make sure the forks (if adjustable) are spread to the widest allowable distance to still fit under the skid.
- Type of forklift used will depend on the terrain the unit is to be moved across during handling.
- Minimum forklift fork length:
  - for 1-fan and 2-fan units—48” (1219mm)
  - for 3-fan and 4-fan units—72” (1829mm)
- When moving the packaged unit, do not lift it any higher than 6" (152mm). If the unit must be lifted higher than 6" (152mm), great care must be exercised and no one may be closer than 20' (6m) to the lift point.
- Vertiv™ recommends lifting one end off the ground no more than 6" (152mm)and using the forklift to push or pull the unit.

Figure 3.2 Forklift position with 1- to 4-fan condensers



Using a Crane

- Vertiv™ recommends using slings rated for the unit weight.
- Spreader bars must be used for sling stability and to keep the slings from pressing against the unit. Make sure spreader bars are wider than the unit.
- Place the slings near the ends of the unit, under the top deck boards of the skid.

3.3 Unit Storage

Store the condenser in the original packaging in an area protected from excessive dirt, debris and contact damage until final installation.

3.4 Unpacking the Condenser—All Unit Sizes

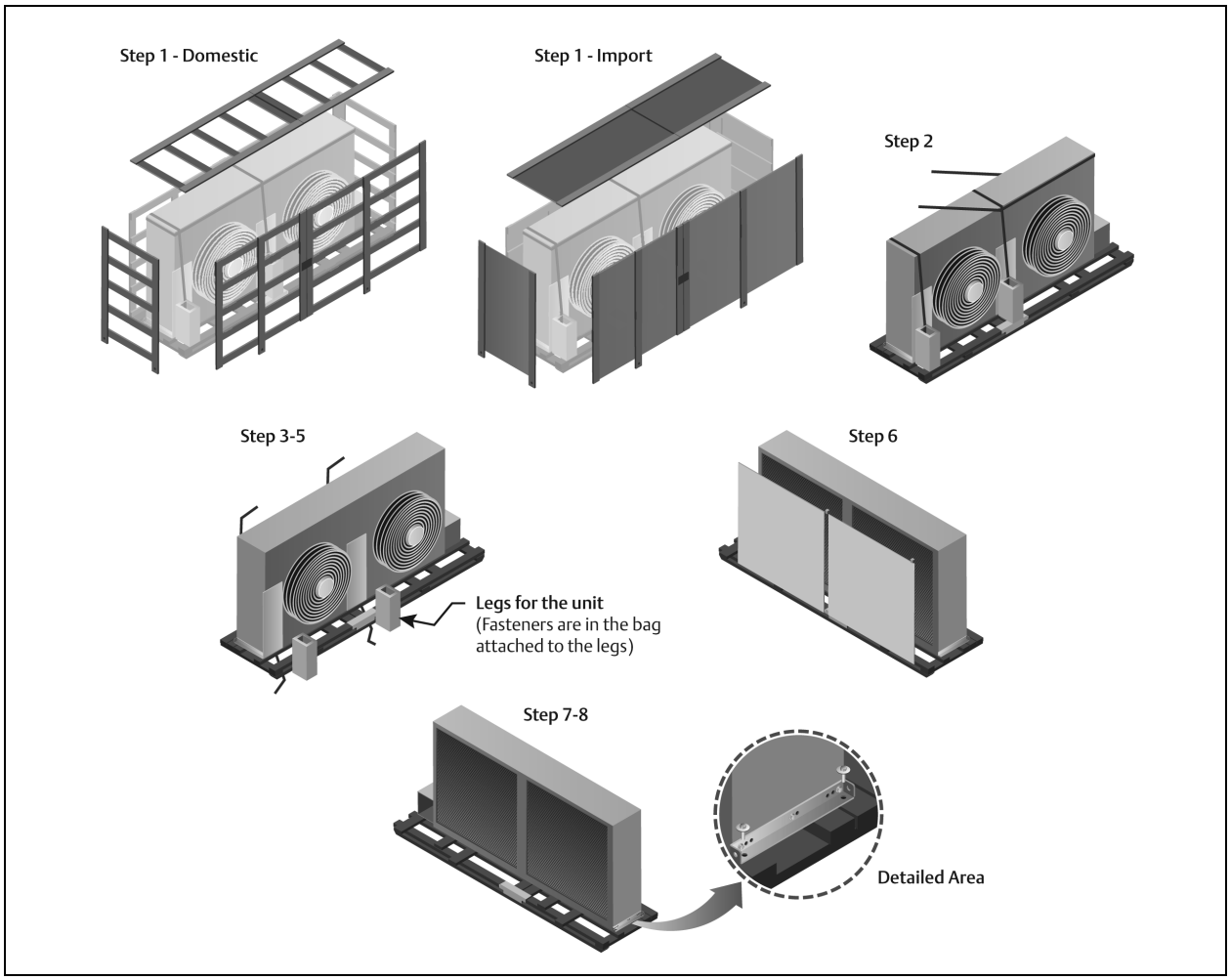
CAUTION: Risk of contact with sharp edges, splinters and exposed fasteners. Can cause personal injury.

Only properly trained and qualified personnel wearing appropriate safety headgear, gloves, shoes and glasses should attempt to move, lift, remove packaging from or prepare unit for installation.

Refer to Figure 3.3 on the next page for the following steps:

1. Remove the fence for domestic packaging (for export packaging, remove the crate).
2. Remove the exterior foam from around the unit and the electric box.
3. Remove the steel straps securing the unit to the skid.
4. Set the legs aside, but keep accessible if legs are shipped together with the unit.
    - Depending on the number of fans, more or less steel straps may be removed at this step.
5. Remove corrugated panels covering the condenser's coil(s).
6. Remove the bolts securing unit to the skid.
7. Remove the bolts securing the brackets to the unit and recycle the brackets.

Figure 3.3 Removing protective material



3.5 Preparing a Condenser for Moving and Installation

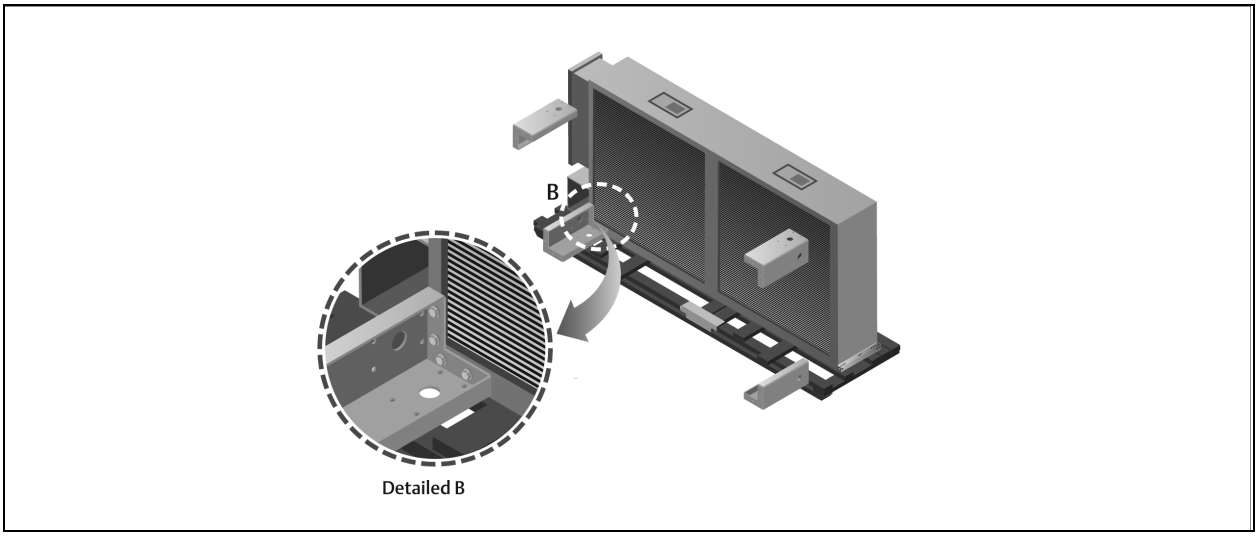
The following procedure is one method for removing a Liebert condenser from its shipping skid. Other methods may be used, provided that they are safe for personnel, the condenser and other equipment.

3.5.1 Attaching 18" (457mm) Legs, Removing the Skid and Attaching Slings

NOTE: Units supplied with 36-60” (914-1524mm) legs go to Attaching 36 to 60 in. (914 to 1524 mm) Legs, Removing the Skid and Attaching Slings on page 33.

1. Attach legs to the unit at indicated locations, using the fasteners provided with the legs.
   - Recommended tools for attachment is a 1/2” (13mm) socket and ratchet.
   - More legs may be available for installation than are shown. This will depend on the unit type and number of fans.

Figure 3.4 Attaching legs to condensers



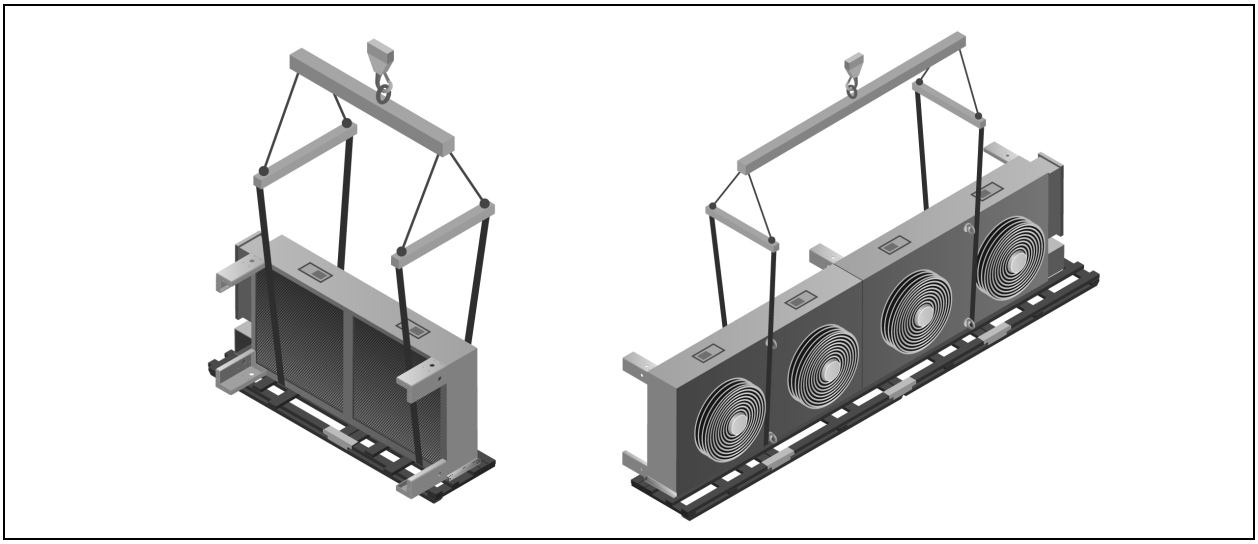
2. Place slings around the unit between the unit and the top deck boards of the skid as shown in Figure 3.5 below:
   - **1-fan and 2-fan units**: against the inside of the attached legs.
   - **3-fan and 4-fan units**: against the outside of the attached eye bolts.
3. Use spreader bars, a lift beam and a crane to lift the unit off the skid. Make sure spreader bars are wider than the unit.

NOTICE

Risk of improper lifting. Can cause equipment damage.

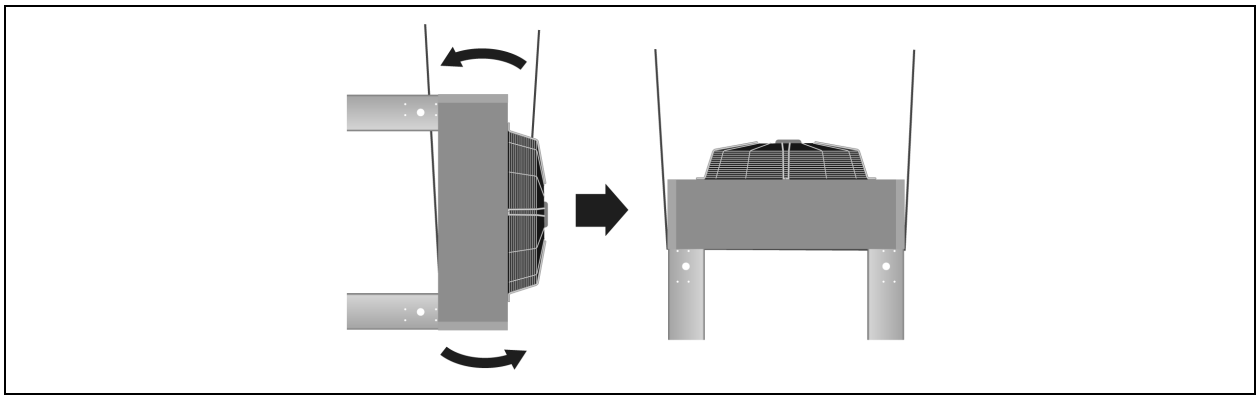
Make sure that the spreader bars wider are than the unit. If the spreader bars are too short, the slings may crush the unit.

Figure 3.5 Securing slings to condensers for lifting off skid



4. Lift the unit 24" (610mm) off the top deck of the skid.
5. Remove the skid from under the unit.
6. To rotate the unit, a mechanized method is recommended, but if one is not available, use a minimum of four properly-protected individuals to rotate the elevated unit 90 degrees so the unit legs are pointing toward the ground, Figure 3.6 below.
7. Set the upright unit on the ground so the legs support unit weight.
8. Remove the straps from around unit.

Figure 3.6 Rotate and set condenser on floor



9. Refer to Figure 3.7 on the facing page to attach rigging for lifting.
   Spreader bars are still required. Make sure that the spreader bars are wider than the unit to prevent crushing force.

- 1-fan and 2-fan units: Route the straps through the large holes in the side of the legs.
- 3-fan and 4-fan units: Secure straps or chains to the eye bolts on top of the unit.

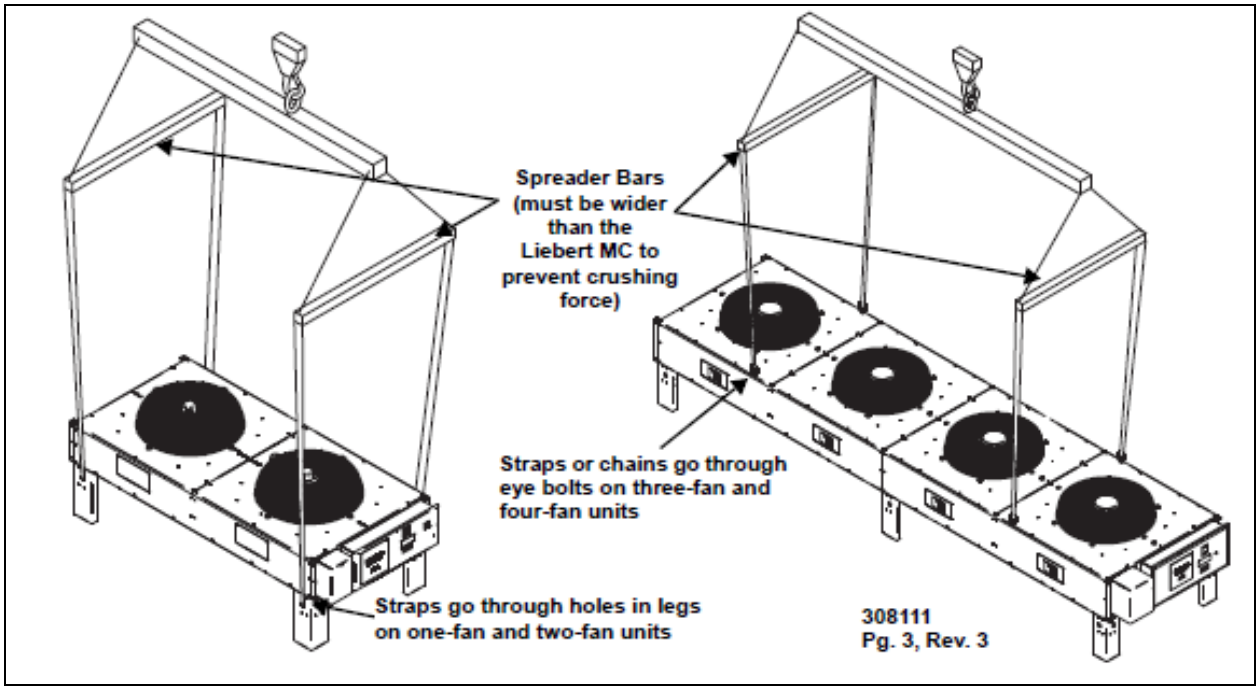
NOTICE

Risk of improper lifting. Can cause equipment damage.

Make sure that the spreader bars wider are than the unit. If the spreader bars are too short, the slings may crush the unit.

The unit is ready to be lifted and moved to its installation location.

Figure 3.7 Rigging to lift condensers

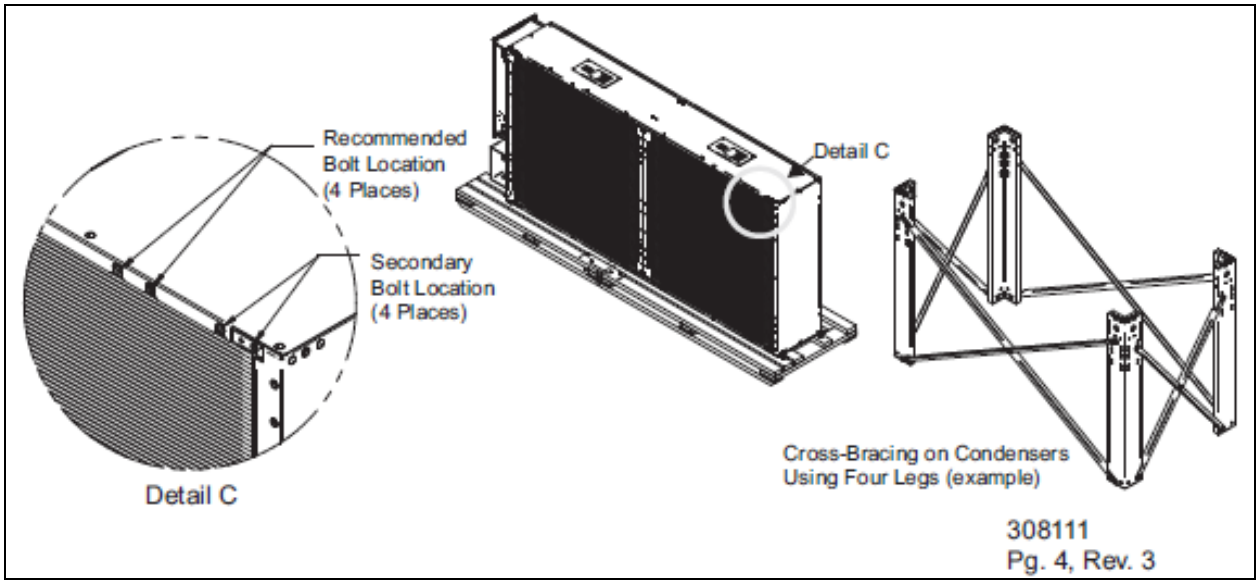


3.5.2 Attaching 36 to 60 in. (914 to 1524 mm) Legs, Removing the Skid and Attaching Slings

1. Install bolts for sling-containment guides during lifting/rotation:
   - Locate the recommended bolt locations shown in Figure 3.8 on the next page.
   - Insert 4 leg bolts, 2 on each end, leaving approximately 1/4 in. (6 mm) of the fastener threads exposed.
   - Do not inser bolt in the secondary bolt locations. These are used to attached the legs after the unit is moved into the installation location.
2. Assemble the leg structure according to the instructions supplied with the legs. Cross-bracing for 4 legs is shown in Figure 3.8 on the next page.

NOTE: When assembling the leg structure, DO NOT tighten the cross-brace hardware until the condenser cabinet is fastened to the legs.

Figure 3.8 Recommended bolt locations for lifting, example cross-bracing for 4 legs



3. To attach rigging for lifting, attach slings between the unit and the top deck boards of the skid as follows:
   Spreader bars are required. Make sure that the spreader bars are wider than the unit to prevent crushing force.
   - 1-fan and 2-fan units: Route the slings against the inside of the inserted leg bolts as shown in Figure 3.9 on the facing page.
   - 3-fan and 4-fan units: Route the slings against the outside of the attached eye bolts.

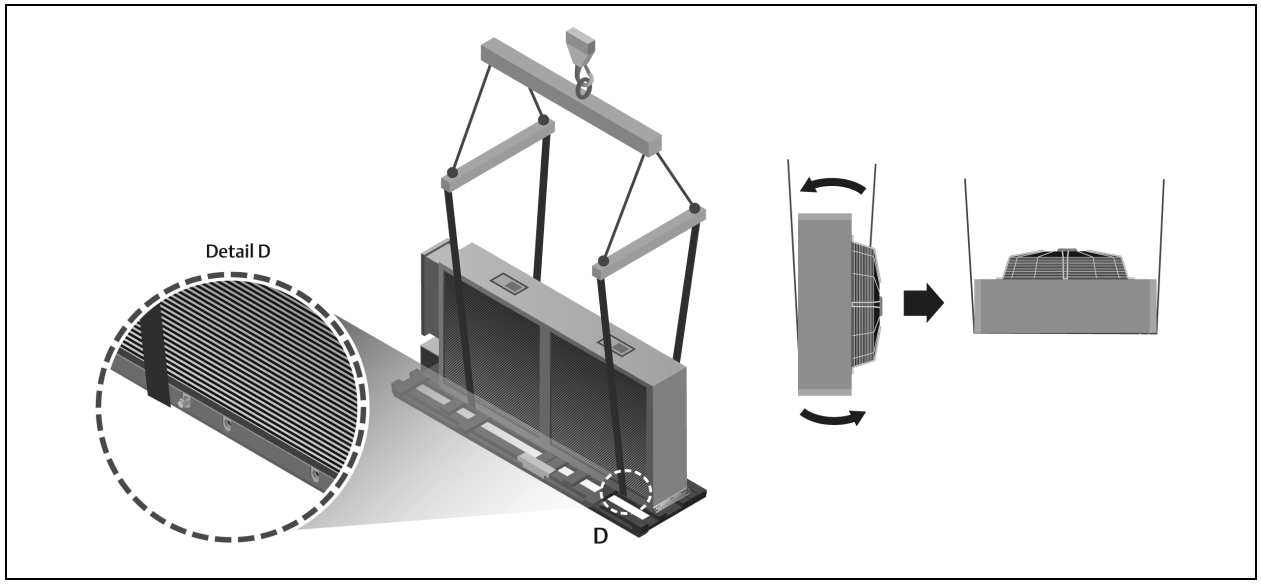
NOTICE

Risk of improper lifting. Can cause equipment damage.

Make sure that the spreader bars wider are than the unit. If the spreader bars are too short, the slings may crush the unit.

4. Use spreader bars, lift beam and crane to lift the the unit 24 in. (610 mm) off the skid. Remove the skid from under the unit
5. To rotate the unit, a mechanized method is recommended, but if one is not available, use a minimum of four properly-protected individuals to rotate the elevated unit 90 degrees so the unit fans are facing up, Figure 3.9 on the facing page.

Figure 3.9 Sling placements and unit rotation



6. Place the unit on the leg structure, resting the unit on the legs.
7. Remove the bolts inserted for strap containment. If the secondary locations were used, remove the bolts just before setting the unit on its legs.
8. Align, insert and tighten all hardware securing the unit to the leg structure.
9. Square-up the leg structure and tighten all cross-brace angle hardware.
10. Lower the unit so the leg structure supports the weight of the unit, and remove the straps from around the unit.
11. Refer to Figure 3.10 on the next page to attach rigging for lifting.
    Spreader bars are still required. Make sure that the spreader bars are wider than the unit to prevent crushing force.

- 1-fan and 2-fan units: Route the straps through the large holes in the side of the legs.
- 3-fan and 4-fan units: Secure straps or chains to the eye bolts on top of the unit.

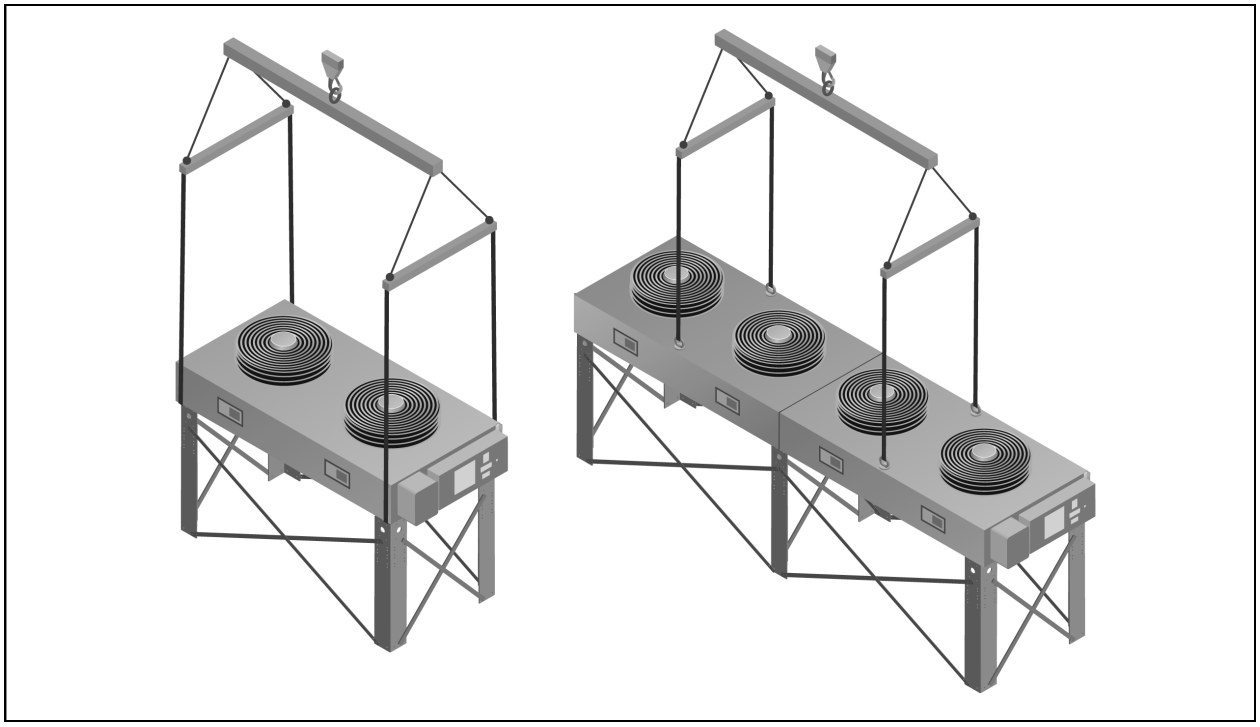
NOTICE

Risk of improper lifting. Can cause equipment damage.

Make sure that the spreader bars wider are than the unit. If the spreader bars are too short, the slings may crush the unit.

The unit is ready to be lifted and moved to its installation location.

Figure 3.10 Rigging to lift the unit for installation



3.6 Mounting the Condenser

The condenser must be installed so that it is level within 1/2" (13mm) to ensure proper refrigerant flow. For roof installation, mount the condenser on suitable curbs or other supports. Follow all local and national codes.

3.6.1 Standard Mounting Requirements

Secure the legs to the mounting surface using field-supplied 3/8" (9.5mm) diameter Grade 5 bolts with a flat washer in each of the two 1/2" x 1" (12.7 x 25.4mm) obround holes in each leg. See Figure 2.1 on page 18 through Figure 2.4 on page 21 for anchor dimensions.

3.6.2 Seismic-Certified and Wind-Certified Mounting Requirements

Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special inspection and attachment to non-building structures must be outlined and approved by the engineer of record for the project or building.

Structural floors and housekeeping pads must also be designed and approved by the project or building structural engineer of record to withstand the seismic or wind anchor loads as defined on the installation drawings. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirements detailed in the seismic or wind installation drawings and additionally outlined by the engineer of record.

At a minimum, 3/8” Grade 5 anchors with American National Standard Series W, Type A, plain washers (ANSI B18.22.1-1965, R1975) selected to match the nominal anchor diameter must be installed at each anchor location between the anchor head and equipment for tension load distribution. See Liebert Seismic Application—Optional Unit Configuration on page 99 for additional information.

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4 ELECTRICAL CONNECTIONS

Line voltage electrical service is required for all models. Refer to the equipment's nameplate regarding wire size and circuit protection requirements. Electrical service must conform to national and local electrical codes. Refer to Figure 4.8 on page 50 for electrical service entrances into unit. Refer to electrical schematic when making connections.

A manual electrical disconnect switch should be installed in accordance with local codes. Consult local codes for external disconnect requirements.

All internal wiring is completed at the factory.

WARNING! Risk of electrical shock. Can cause injury or death.

The fan speed control and the EC fan electrical enclosures may contain a stored electrical charge. Open all local and remote electric power disconnect switches, wait 10 minutes and verify with a voltmeter that power is Off before working within the fan speed control and the EC fan electrical enclosures.

The LiebertMC contains lethal voltage in some circuits. The line side of the disconnect remains energized when the condenser unit disconnect is switched to the Off position.

Use a voltmeter to verify that the line-side electrical power is Off before making any electrical connections or performing any electrical and/or mechanical service and/or maintenance operations.

WARNING! Risk of contact with high-speed, rotating fan blades. Can cause serious injury or death.

Fan blades can automatically start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Open all local and remote electric power supply disconnect switches and verify with a voltmeter that the power is Off and that the fan blades have stopped rotating before working within the cabinet or servicing fan motors.

Each unit is shipped from the factory with all internal wiring completed. Refer to the electrical schematic supplied with the condenser when making line voltage supply, low-voltage indoor unit interlock and any low-voltage alarm connections. All wiring must be done in accordance with all applicable local, state and national electrical codes.

NOTE: Installation and service of this equipment should be done only by properly trained and qualified personnel who have been specially trained in the installation of air conditioning equipment.

NOTE: Use copper wiring only. Make sure that all connections are tightened to the proper torque mentioned on the component.

4.1 Line Voltage Wiring

WARNING! Risk of electrical fire and short circuit. Can cause property damage, injury or death.

Select and install the line side electrical supply wire and overcurrent protection device(s) according to the specifications on the unit nameplate(s), per the instructions in this manual and according to the applicable national, state and local code requirements. Use copper conductors only.

Verify that all electrical connections are tight. Unit-specific wiring diagrams are provided on each unit.

NOTE: The LiebertMC Condenser is designed to operate with Wye-connected power with a solidly grounded neutral. It will not operate properly with Wye-connected power with high-resistance (or impedance) ground or with delta-connected power. Refer to Wye- vs. Delta-Connected Power Supply on page 42.

Condenser-rated voltage should be verified with available power supply before installation. Refer to the unit's electrical schematic and serial tag for specific electrical requirements.

Liebert MC condenser power connections are provided for three-phase wires and 1 earth ground wire. Line voltage electrical service is required for all condensers at the location of the condenser. The voltage supply to the condenser may not be the same voltage supply as required by the indoor unit. Consider using a UPS on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability. Refer to the unit's serial tag for specific condenser electrical requirements. A unit disconnect is standard. However, a site disconnect may be required by local code to isolate the unit for maintenance. Route the supply power to the site disconnect switch and then to the unit. Route the conduit to the knockout provided in the bottom right end of the electrical control enclosure. Connect the earth ground wire lead to the marked earth ground connection terminal provided near the factory-installed disconnect switch (see Figure 4.8 on page 50).

NOTE: Liebert Lee-Temp™ kits require a separate line voltage electrical supply for the heated receivers. See Table 4.2 on the facing page for power requirements.

Table 4.1 Electrical data, three-phase, 60Hz condenser, premium models

Model	Voltage	FLA	WSA	OPD
Small Platform				
MCS028	208/230V	3.0	3.8	15
	380V	1.4	1.8	15
	460V	1.4	1.8	15
	575V	1.2	1.5	15
MCS056	208/230V	6.0	6.8	15
	380V	2.8	3.3	15
	460V	2.8	3.3	15
	575V	2.3	2.8	15
Medium Platform				

Table 4.1 Electrical data, three-phase, 60Hz condenser, premium models (continued)

Model	Voltage	FLA	WSA	OPD
MCM040	208/230V	2.3	3.2	15
	380V	1.4	1.9	15
	460V	1.4	1.9	15
	575V	1.2	1.6	15
MCM080	208/230V	4.6	5.5	15
	380V	2.8	3.3	15
	460V	2.8	3.3	15
	575V	2.3	2.8	15
MCM160	208/230V	9.2	9.8	15
	380V	5.6	6.0	15
	460V	5.6	6.0	15
	575V	4.7	5.0	15
Large Platform				
MCL055	208/230V	5.7	7.1	15
	380V	2.8	3.5	15
	460V	2.8	3.5	15
	575V	2.3	2.9	15
MCL110	208/230V	11.4	12.8	15
	380V	5.6	6.3	15
	460V	5.6	6.3	15
	575V	4.7	5.3	15
MCL165	208/230V	17.1	18.5	20
	380V	8.4	9.1	15
	460V	8.4	9.1	15
	575V	7.0	7.6	15
MCL220	208/230V	22.8	24.2	25
	380V	11.2	11.9	15
	460V	11.2	11.9	15
	575V	9.3	9.9	15

1. FLA = Full Load Amps; WSA = Wire Size Amps; OPD = Maximum Overcurrent Protection Device.
2. 208V–575V premium models must be connected to Wye three-phase systems.
3. Wye 3-phase systems with solidly grounded neutral. Refer to Wye- vs. Delta-Connected Power Supply on the next page.

Table 4.2 Electrical data, Liebert Lee-Temp™ receiver, 60Hz

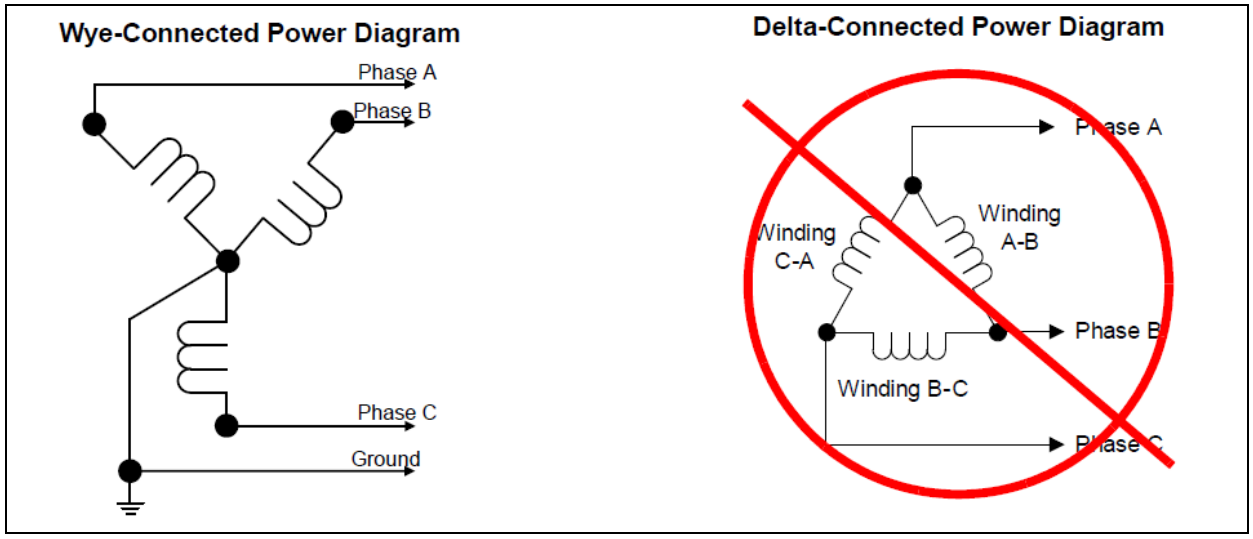
Rated Voltage - Single-Phase	120		208/230	
Watts/Receiver	150	300	150	300
Amps	1.4	2.8	0.7	1.4

Table 4.2 Electrical data, Liebert Lee-Temp™ receiver, 60Hz (continued)

Wire Size Amps	1.8	3.5	0.9	1.8
Maximum Overcurrent Protection Device, Amps	15	15	15	15
The Liebert Lee-Temp receiver requires a separate power feed for heaters. The condenser is not designed to supply power to the receiver heater pads.				

4.1.1 Wye- vs. Delta-Connected Power Supply

Figure 4.1 Wye- vs. delta-connected power supply connection diagram



NOTICE

Risk of improper input power. Can cause equipment damage.

The Liebert MC Condenser is designed to operate with Wye-connected power with a solidly grounded neutral. It will not operate properly with Wye-connected power with high-resistance (or impedance) ground or with delta-connected power. Refer to Wye- vs. Delta-Connected Power Supply above

NOTE: A separate neutral wire does not need to be run to the LiebertMC.

Acceptable Power Supplies—208V to 575V Nominal Units

- 208V Wye with solidly grounded neutral and 120V line-to-ground
- 380V Wye with solidly grounded neutral and 220V line-to-ground
- 480V Wye with solidly grounded neutral and 277V line-to-ground
- 575V Wye with solidly grounded neutral and 332V line-to-ground (uses step-down tranformers)

Unacceptable Power Supplies—208V to 575V Nominal Units

- Wye with high-resistance (or impedance) ground
- Delta without ground or with floating ground
- Delta with corner ground

- Delta with grounded center tap

4.2 Low-voltage Control Wiring—CANbus Communication and Interlock Connections

NOTICE

Risk of control malfunction. Can cause improper unit operation.

Verify that all low-voltage electrical wiring has been performed per the schematic diagram provided and that all low-voltage wiring connections are tight.

CANbus communication and interlock wiring are required between the indoor and the outdoor units. CANbus cables are supplied by others to connect the indoor unit to the outdoor condenser. No special considerations are required when the total external cable connection between the indoor unit and outdoor unit is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections longer than 450 ft. (137m) but less than 800 ft. (243m).

CANbus Cable Requirements

- conductors 22-18AWG stranded tinned copper
- twisted pair (minimum four twists per foot)
- braided shield or foil shield with drain wire
- shield must always be wired to ground at the indoor unit
- low capacitance (15pF/ft or less)
- UL-approved temperature rated to 75°C
- UL-approved voltage rated to 300V
- UV-resistant and moisture-resistant if not run in conduit
- plenum-rated NEC Type CMP, if required by national or local codes
- Examples include: Belden 89207 (plenum-rated), or Alpha Wire 6454 Category 5, 5e or higher

Interlock wiring is field-supplied wiring between Terminals 70 and 71 for single-circuit models and Terminal 230 also for dual-circuit models. Total interlock wire length must be less than 1000 ft. (305 m).

Field-Supplied Interlock Wire

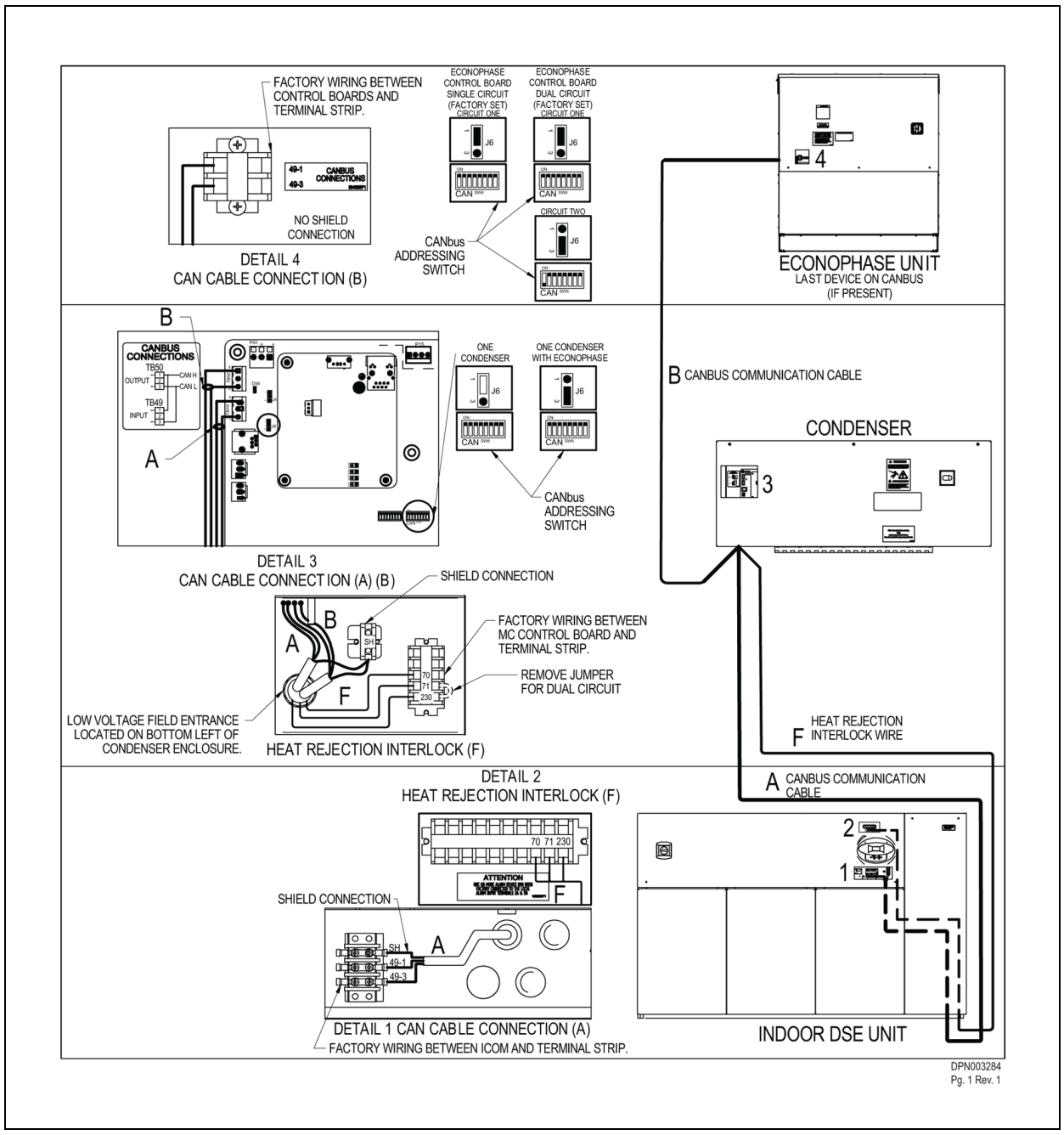
- 18AWG or greater
- rated 600V

Notes on Electrical Connections

- Do not run CANbus cable and interlock wires in same conduit, racewary or chase as high-voltage wiring.
- No special considerations are required when the total external cable connection between the indoor unit and outdoor unit(s) is less than 450 ft. (137m). A CANbus isolator is required for total external cable connections greater than 450 ft. (137m) but less than 800 ft. (243m).
- All wiring must be sized and selected for insulation case per NEC and other applicable codes.
- Do not bend cables to less than four times the diameter of the cable.
- Do not deform cables when securing in bundles or when hanging them.

- Avoid running the cables by devices that may introduce noise, such as machines, fluorescent lights, and electronics.
- Avoid stretching cables.
- Keep CANbus cables at least 12 inches (305mm) from high-voltage sources, including wiring.

Figure 4.2 CANbus communication and interlock connections between a Liebert DSE, one premium Liebert MC and a Liebert EconoPhase

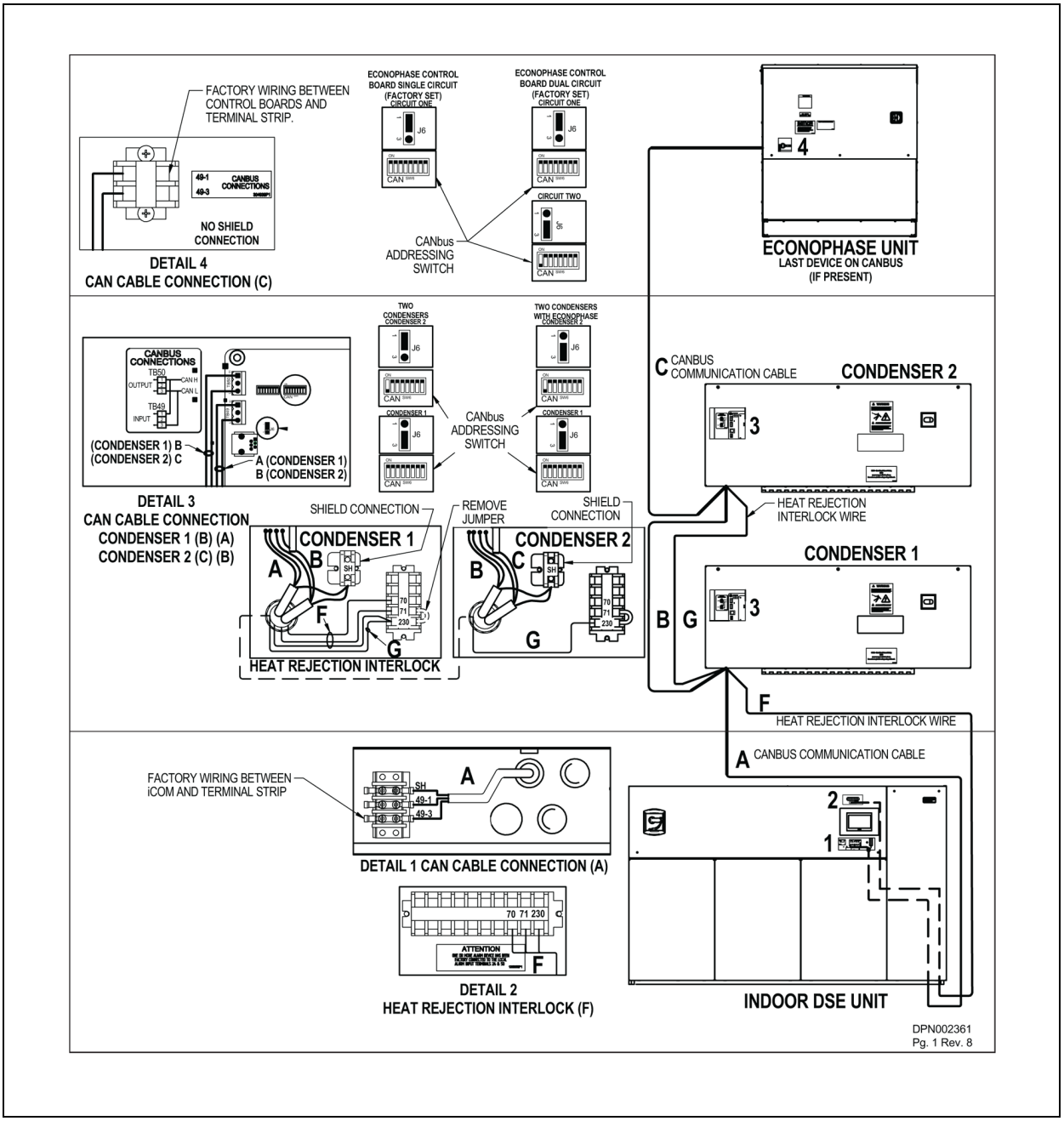


CANbus Cable: A, B

Interlock Wire: F

See Low-voltage Control Wiring—CANbus Communication and Interlock Connections on page 43 for cable and wire requirements.

Figure 4.3 CANbus communications and interlock connections between a Liebert DSE, two Liebert MC condensers and a Liebert EconoPhase

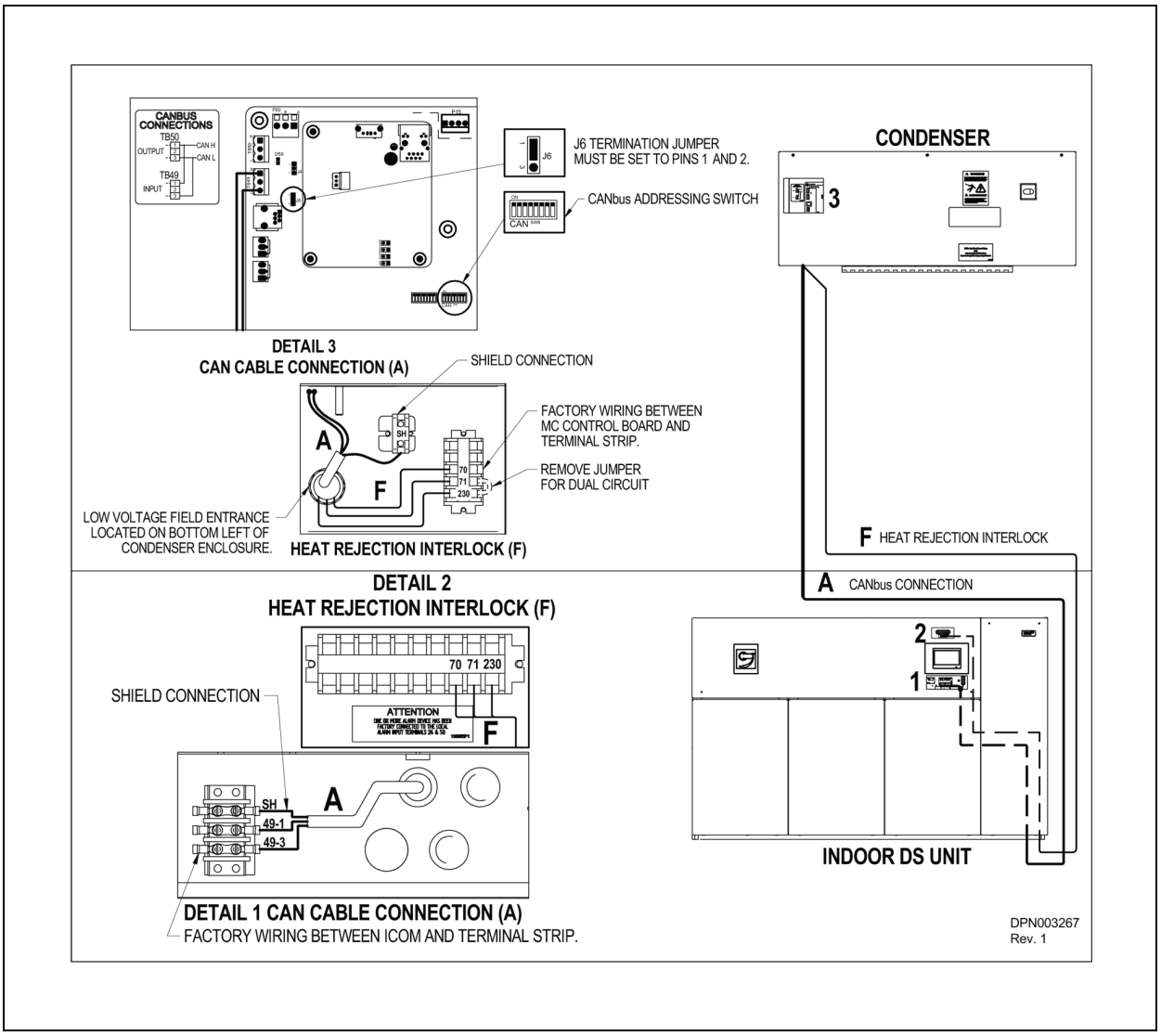


CANbus Cable: A, B, C

Interlock Wire: F, G

See Low-voltage Control Wiring—CANbus Communication and Interlock Connections on page 43 for cable and wire requirements.

Figure 4.4 CANbus communications and interlock connections between a Liebert DS and Liebert MC condenser

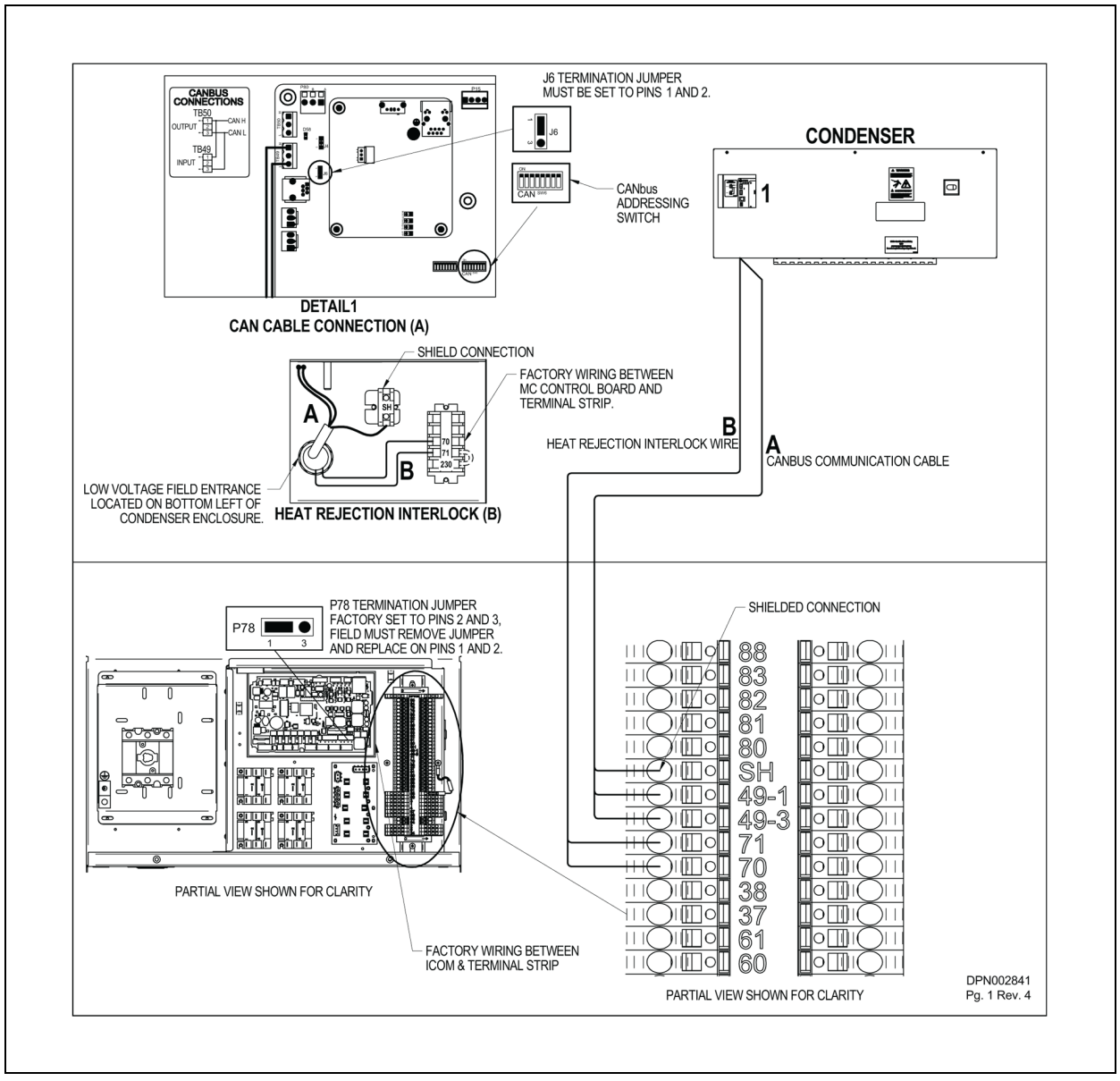


CANbus Cable: A

Interlock Wire: F

See Low-voltage Control Wiring—CANbus Communication and Interlock Connections on page 43 for cable and wire requirements.

Figure 4.5 CANbus communication and interlock connections between a Liebert CRV 600 mm (24 in.) and a Liebert MC premium condenser

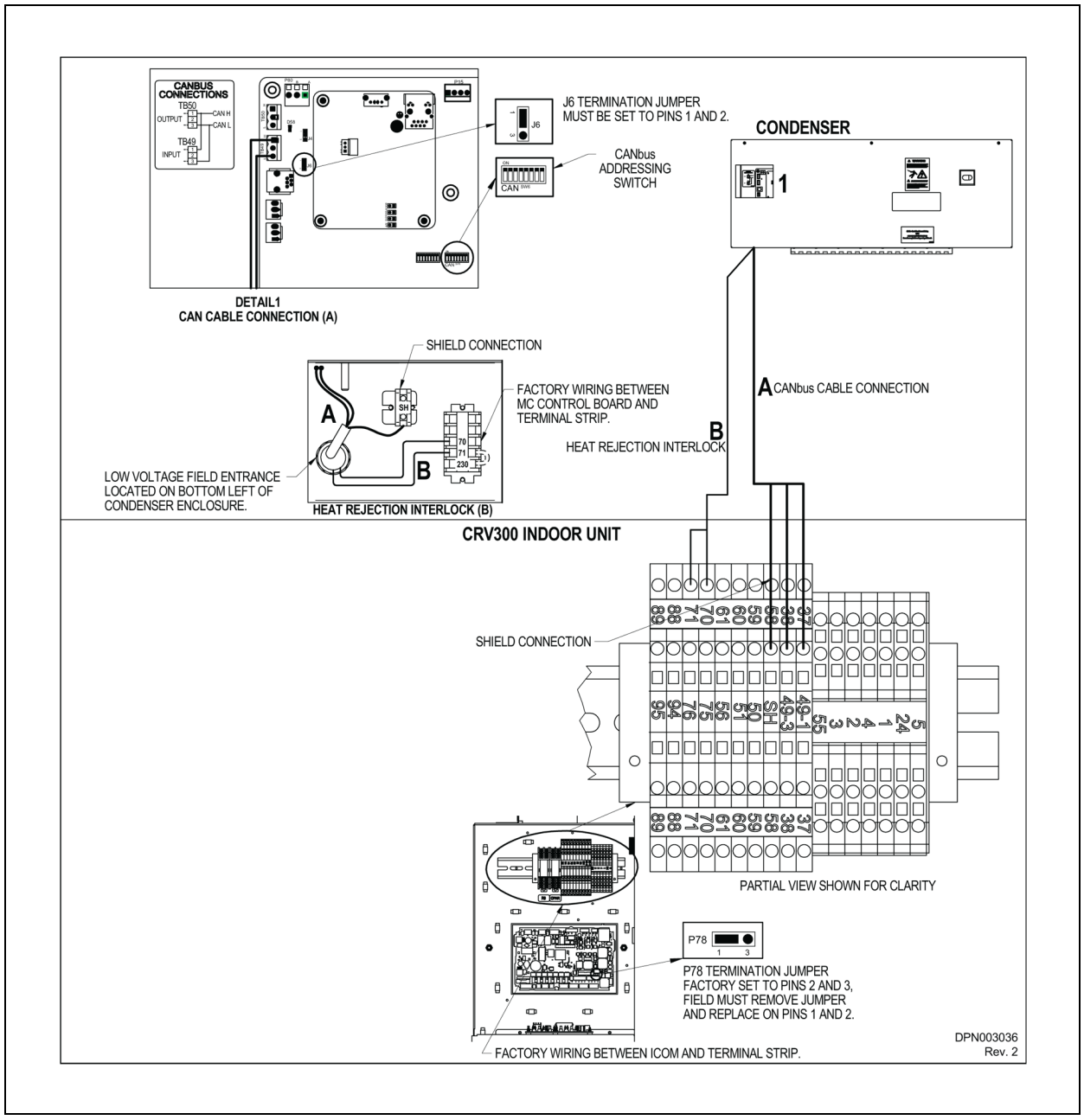


CANbus Cable: A

Interlock Wire: B

See Low-voltage Control Wiring—CANbus Communication and Interlock Connections on page 43 for cable and wire requirements.

Figure 4.6 CANbus communications and interlock connection between Liebert CRV 300 mm (12 in.) and a Liebert MC premium condenser

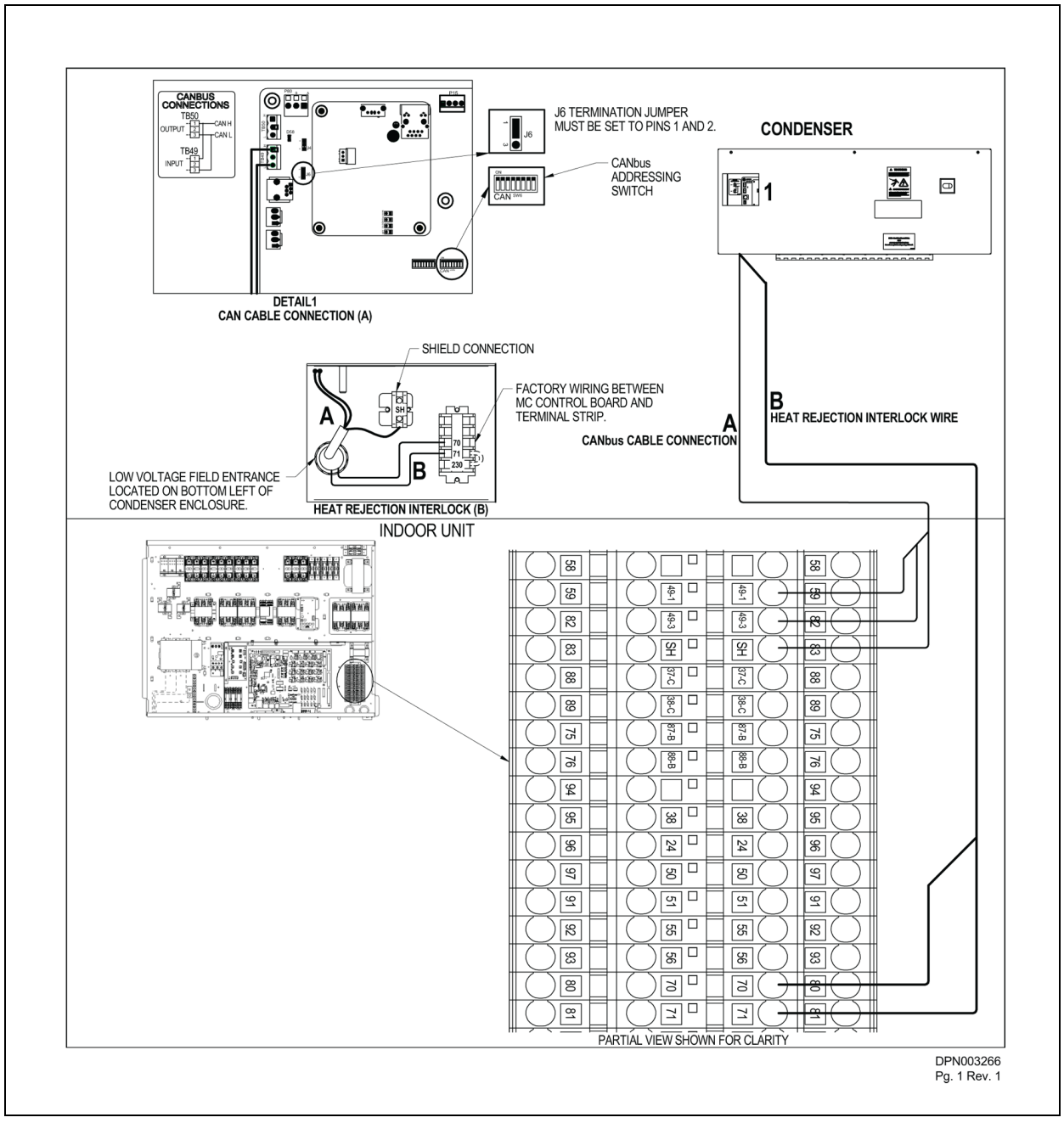


CANbus Cable: A

Interlock Wire: B

See Low-voltage Control Wiring—CANbus Communication and Interlock Connections on page 43 for cable and wire requirements.

Figure 4.7 CANbus communication and interlock connection between Liebert PDX™ and a Liebert MC premium condenser



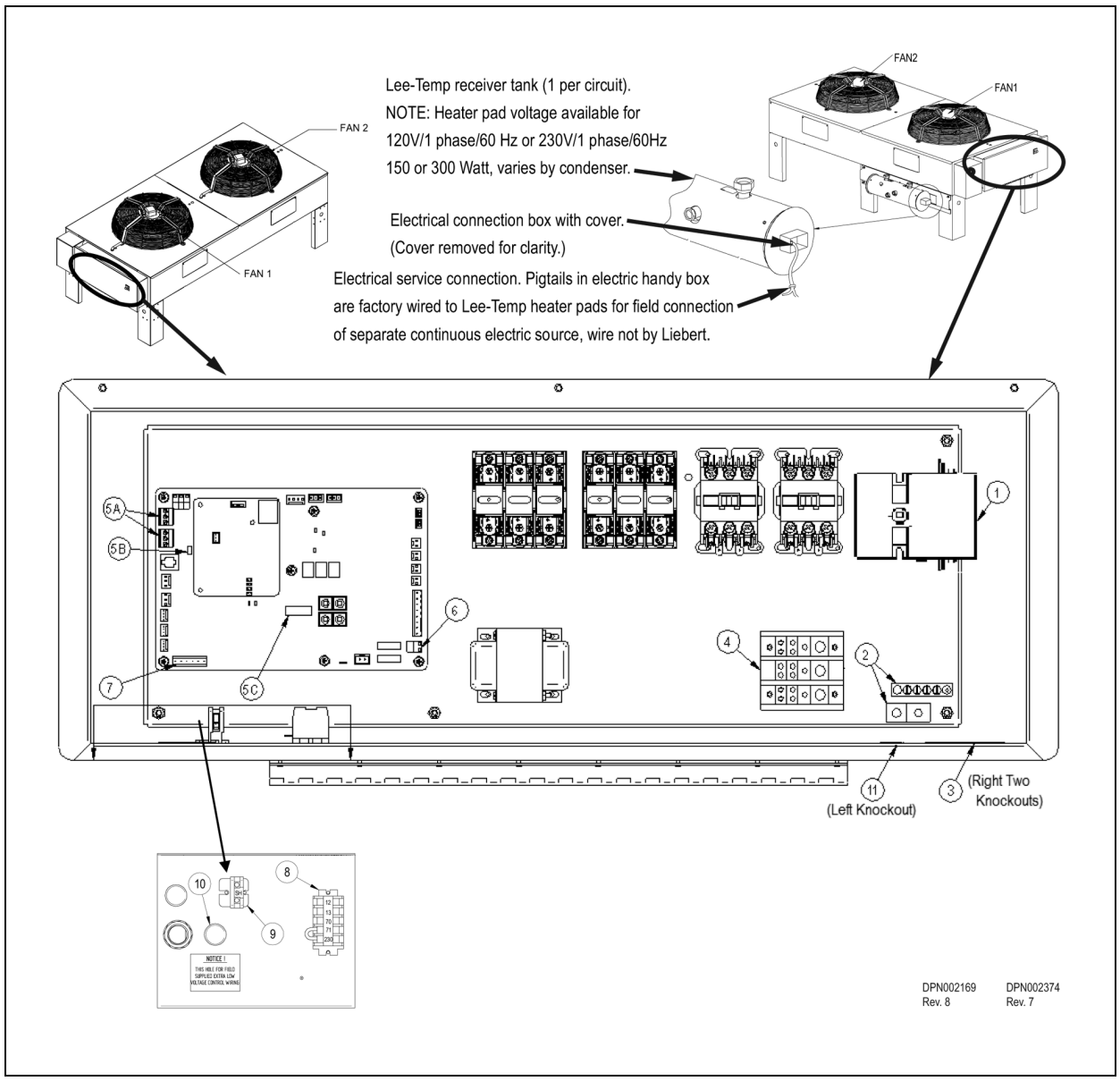
CANbus Cable: A

Interlock Wire: B

See Low-voltage Control Wiring—CANbus Communication and Interlock Connections on page 43 for cable and wire requirements.

4.2.1 Electrical Field Connection Descriptions

Figure 4.8 Typical connections, Premium Efficiency Control



Key Electrical Details—Typical Connections, Premium Efficiency Control

Source: DPN002169, Rev. 7 and DPN002374, Rev. 6. The following numbered items correspond to the callouts in Figure 4.8 above.

1. Three-Phase Electrical Service—Terminals are on the top of the disconnect switch for one-fan and two-fan units. Terminals are on the bottom of the disconnect switch for three-fan and four-fan units. Three-phase service not by Vertiv™. See NOTICE on page 43.
2. Earth Ground—Field lug terminal for earth ground connection. Ground terminal strip for fan motor ground connection.

3. Primary High-Voltage Entrance—Two knockouts, each 7/8" (22.2mm) diameter, located at the bottom of the enclosure.
4. SPD Field Connection Terminals—High-voltage surge protective device (SPD) terminals. SPD is an optional device.
5. CANbus Terminal Connections—Field terminals for CANbus cable connection.
   - 5A is the CANbus connectors

     TB49-1 is the input terminal for CANbus high.

     TB49-3 is the input terminal for CANbus low.

     TB50-1 is the output terminal for CANbus high.

     TB50-3 is the output terminal for CANbus low.

     Each CANbus cable shield is connected to terminal "SH;" seeCANbus Shield Terminal—Terminal for field shield connection of the CANbus field-supplied cables. The shield of CANbus field-supplied cables must not be connected to ground at the condenser. below below.
   - 5B is the "END OF LINE" jumper.
   - 5C is the CANbus "DEVICE ADDRESS DIP SWITCH." CANbus cable not by Vertiv™. See requirements in Notes on Electrical Connections on page 43.
6. Remote Unit Shutdown—Replace exiting jumper between Terminals TB38-1 and TB38-2 with field-supplied, normally closed switch having a minimum 75VA, 24VAC rating. Use field-supplied Class 1 wiring. (This is an optional feature.)
7. Alarm Terminal Connections
   a. Common Alarm Relay indicates when any type of alarm occurs. TB74-1 is common; TB74-2 is normally open; and TB74-3 is normally closed. 1A 24VAC is the maximum load. Use field-supplied Class 1 wiring.
   b. Shutdown Alarm Relay indicates when condenser loses power or when a critical alarm has occurred that shuts down the condenser unit. TB74-4 is common; TB74-5 is normally open; and TB74-6 is normally closed. 1 Amp 24VAC is the maximum load. Use field-supplied Class 1 wiring.
8. Indoor Unit Interlock and SPD Alarm Terminals
   a. On any call for compressor operation, normally open contact is closed across Terminals 70 and 71 for Circuit 1 and normally open contact is closed across Terminals 70 and 230 for Circuit 2 from indoor unit.
   b. During SPD alarm, normally open contact is closed across Terminals 12 and 13. (SPD is an optional device.)
9. CANbus Shield Terminal—Terminal for field shield connection of the CANbus field-supplied cables. The shield of CANbus field-supplied cables must not be connected to ground at the condenser.
10. Primary Low-Voltage Entrance—One knockout, 7/8" (22.2mm) diameter, that is free for customer low-voltage wiring.
11. SPD entrance—One knockout, 7/8" (22.2mm) diameter at the bottom of the enclosure. (High-voltage surge protective device is optional.)

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5 PIPING

WARNING! Risk of explosive discharge from high-pressure refrigerant. Can cause equipment damage, injury or death.

Relieve pressure before working with or cutting into piping.

WARNING! Risk of refrigerant system rupture or explosion from overpressurization. Can cause equipment damage, injury or death.

Local building and plumbing codes may require that a fusible plug or other type of pressure relief device be installed in the system. Do not install a shutoff valve between the compressor and the field-installed relief device.

Consult local building and plumbing codes for installation requirements of additional pressure relief devices when isolation valves are installed as shown in Figure 5.1 on page 55. Do not isolate any refrigerant circuits from over-pressurization protection.

NOTE: POE (polyol ester) oil, required with R-407C/R-410A and used with some R-22 systems, is much more hygroscopic than mineral oils. This means that POE oil absorbs water at a much faster rate when exposed to air than previously used mineral oils. Because water is the enemy of a reliable refrigeration system, extreme care must be used when opening systems during installation or service. If water is absorbed into the POE oil, it will not be easily removed and will not be removed through the normal evacuation process. If the oil is too wet, it may require an oil change. POE oils also have a property that makes them act as a solvent in a refrigeration system. Maintaining system cleanliness is extremely important because the oil will tend to bring any foreign matter back to the compressor or plug the microchannel coil. Always use a flow of dry nitrogen when brazing.

5.1 Piping Guidelines

Indoor units and condensers both ship with holding charges of inert gas. Do not vent the condenser until all refrigerant piping is in place, ready for connection to indoor unit and condenser.

- Use copper piping with a brazing alloy with a minimum temperature of 1350°F (732°C), such as Sil-Fos. Avoid soft solders such as 50/50 or 95/5.
- Use a flow of dry nitrogen through the piping during brazing to prevent formation of copper oxide scale inside the piping. When copper is heated in the presence of air, copper oxide forms. POE oil will dissolve these oxides from inside the copper pipes and deposit them throughout the system, clogging filter driers and affecting other system components.
- A pure dry nitrogen flow of 1-3 ft^3/min (0.5-1.5 l/s) inside the pipe during brazing is sufficient to displace the air. Control the flow using a suitable metering device.
- Ensure that the tubing surfaces to be brazed are clean and that the ends of the tubes have been carefully reamed to remove any burrs.
- Ensure that all loose material has been cleaned from inside the tubing before brazing.
- Protect all refrigerant line components within 18" (460mm) of the brazing site by wrapping them with wet cloth or suitable heat sink compound.
- Isolate piping from building using vibration isolating supports.

- Refer to the indoor unit's user manual for appropriate piping sizes.
- Install traps on the hot gas (discharge) lines at the bottom of any rise over 5 feet high. If the rise exceeds 25 feet (7.5m), then install a trap in 20 foot (6m) increments or evenly divided.
- Pitch horizontal hot gas piping down at a minimum rate of 1/2" per 10 ft. (42mm per 10m) so that gravity will aid in moving oil in the direction of refrigerant/oil flow.
- Consult factory if Liebert Lee-Temp™ condenser is below the evaporator or if a condenser not equipped with Liebert Lee-Temp is more than 15 ft (4.6m) below the evaporator.
- Consult factory if piping run exceeds 150 feet (46m) equivalent length on traditional R-407C DX units.
- Consult factory if piping run exceeds 300 feet (91m) equivalent length on traditional R-410A DX units.
- Consult factory if piping run exceeds 300 feet (91m) actual length or 450 feet (137m) equivalent length on units installed with Liebert EconoPhase units.
- Keep piping clean and dry, especially on units with POE oil (R-407C, R-410A or R-22 refrigerant).
- Avoid piping runs through noise-sensitive areas.
- Do not run piping directly in front of indoor unit discharge air stream.
- Refrigerant oil – do not mix oil types or viscosities. Consult indoor unit for refrigerant type and oil requirements.

NOTE: Failure to use compressor oils recommended by compressor manufacturer will void compressor warranty. Consult Vertiv™ or the compressor manufacturer for further recommendations or if you have questions about compressor oils.

Refer to ASHRAE Refrigeration Handbook for general good practices for refrigeration piping. The Liebert indoor cooling unit has a factory-installed high-pressure safety switch in the high side refrigerant circuit. A pressure relief valve is provided with Liebert Lee-Temp™ receivers. A fusible plug is factory installed in the Liebert DSE™ receivers. Consult local building codes to determine if condensers without receivers will require field-provided pressure relief devices. A fusible plug kit is available for field installation.

Figure 5.1 Piping schematic—DX systems

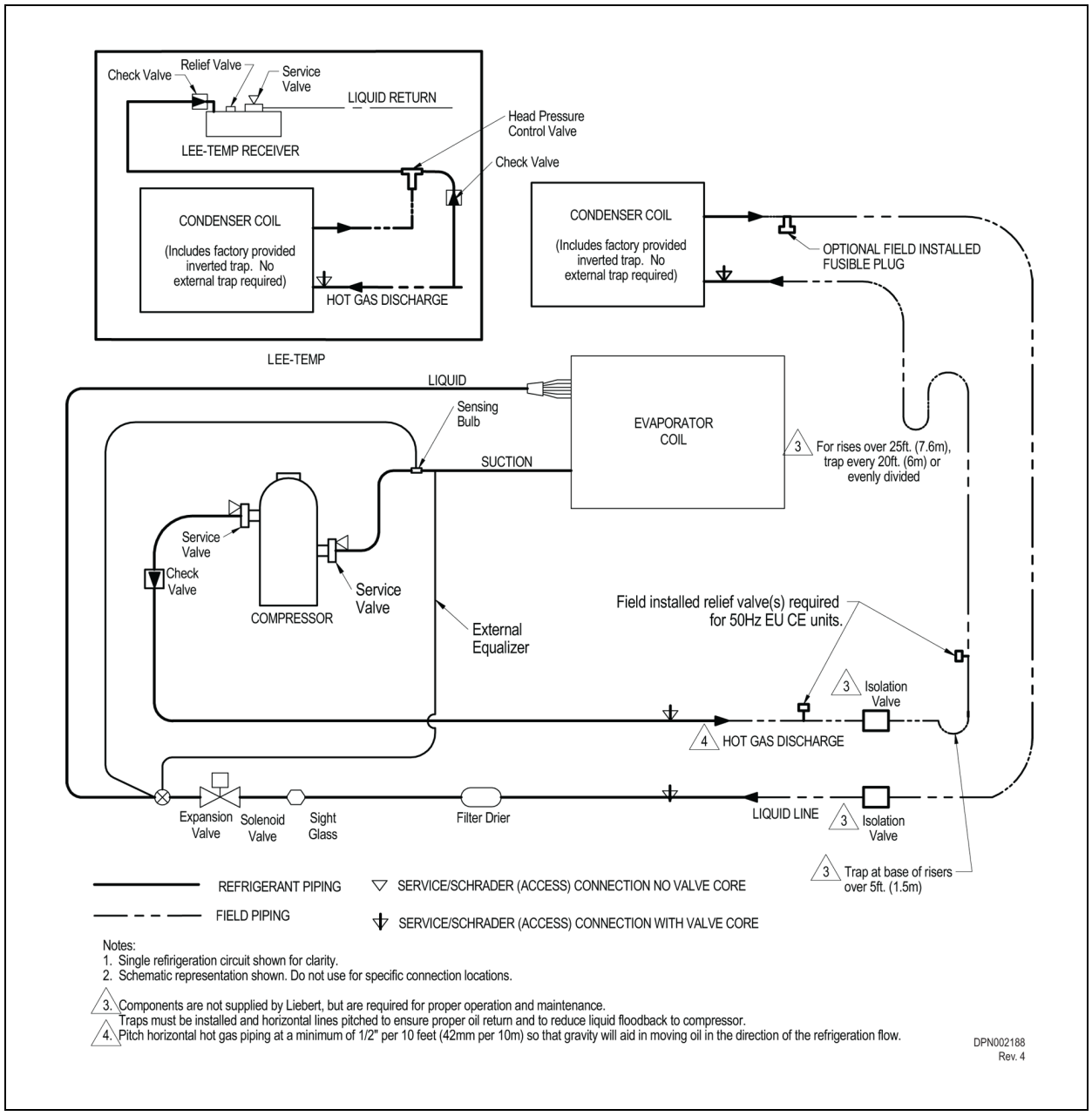


Figure 5.2 Piping schematic—CRV 600 mm (24 in.) DX systems

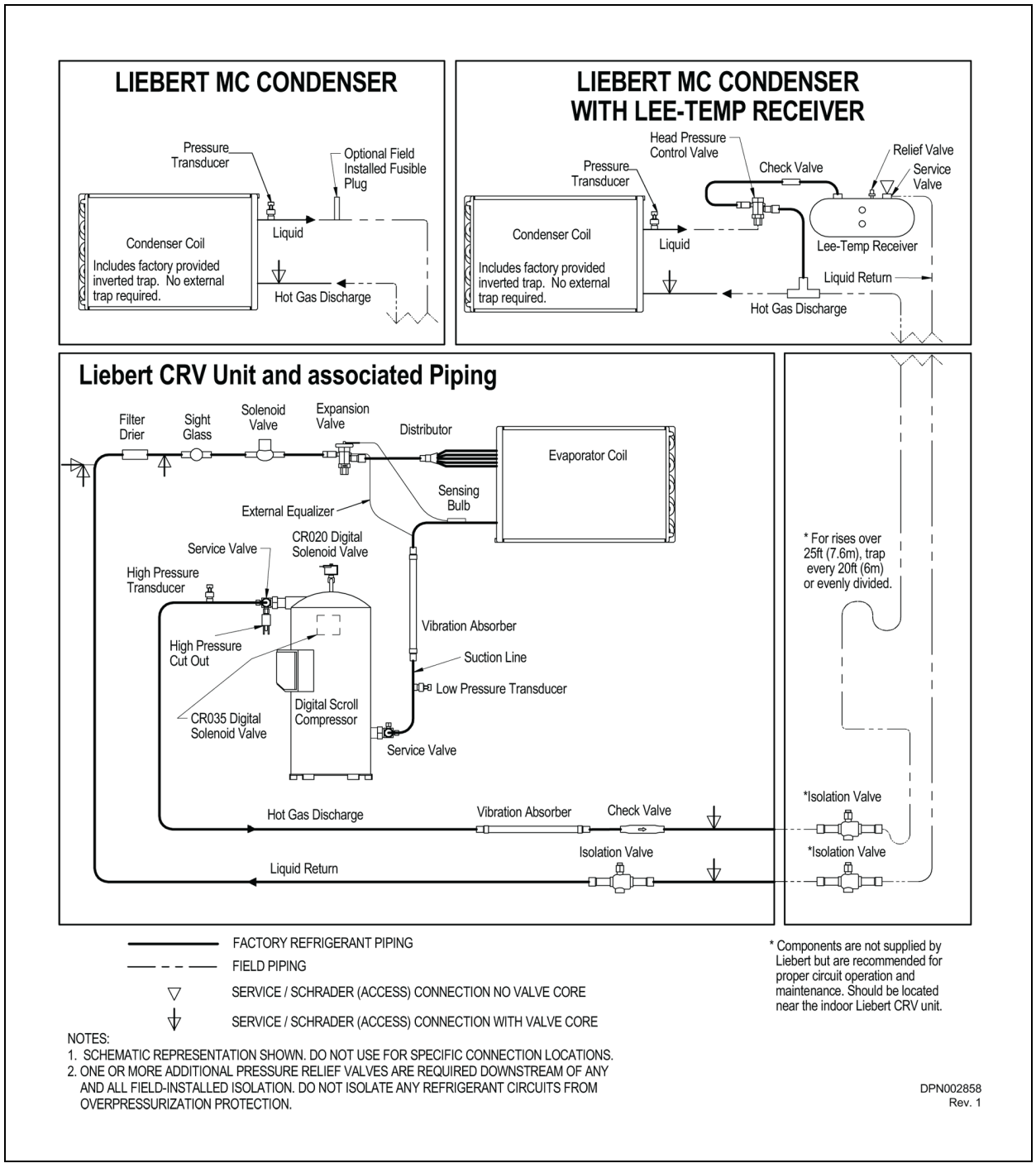


Figure 5.3 Piping schematic—CRV300 mm (12 in.) DX systems

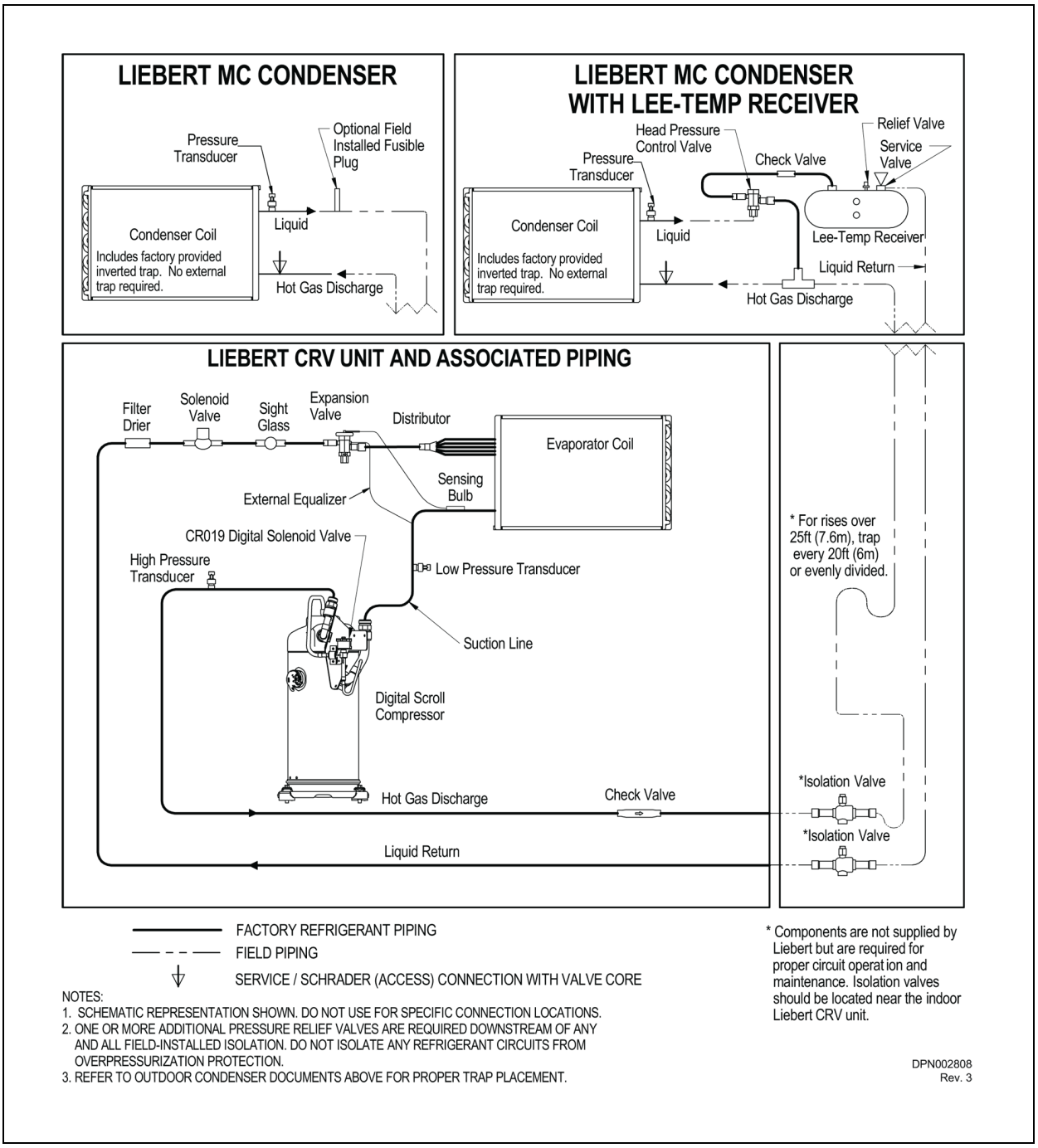


Figure 5.4 Piping schematic—DS DX systems

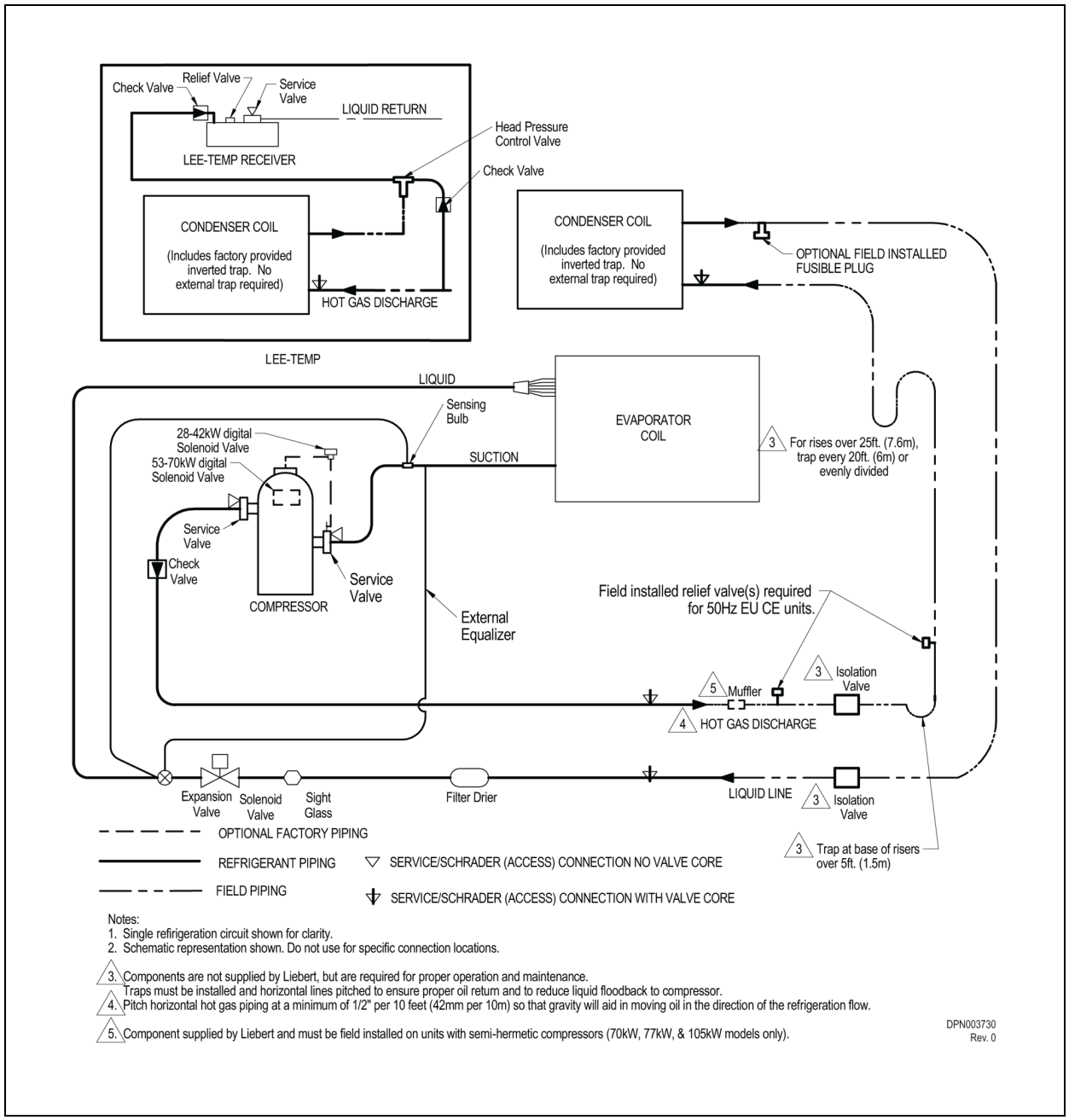


Figure 5.5 Piping schematic—Liebert DSE™, air-cooled DA050, DA080 and DA085 models

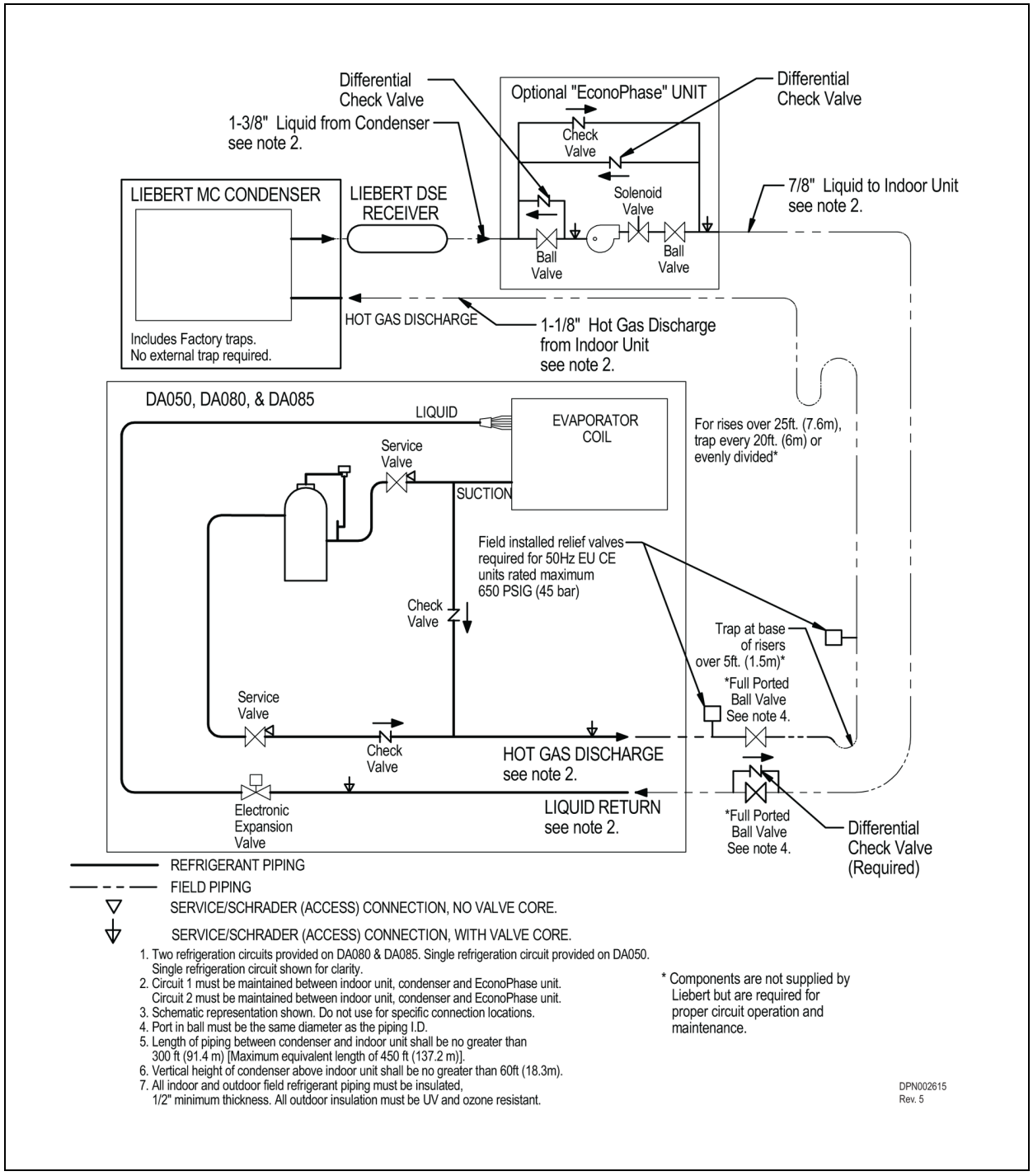
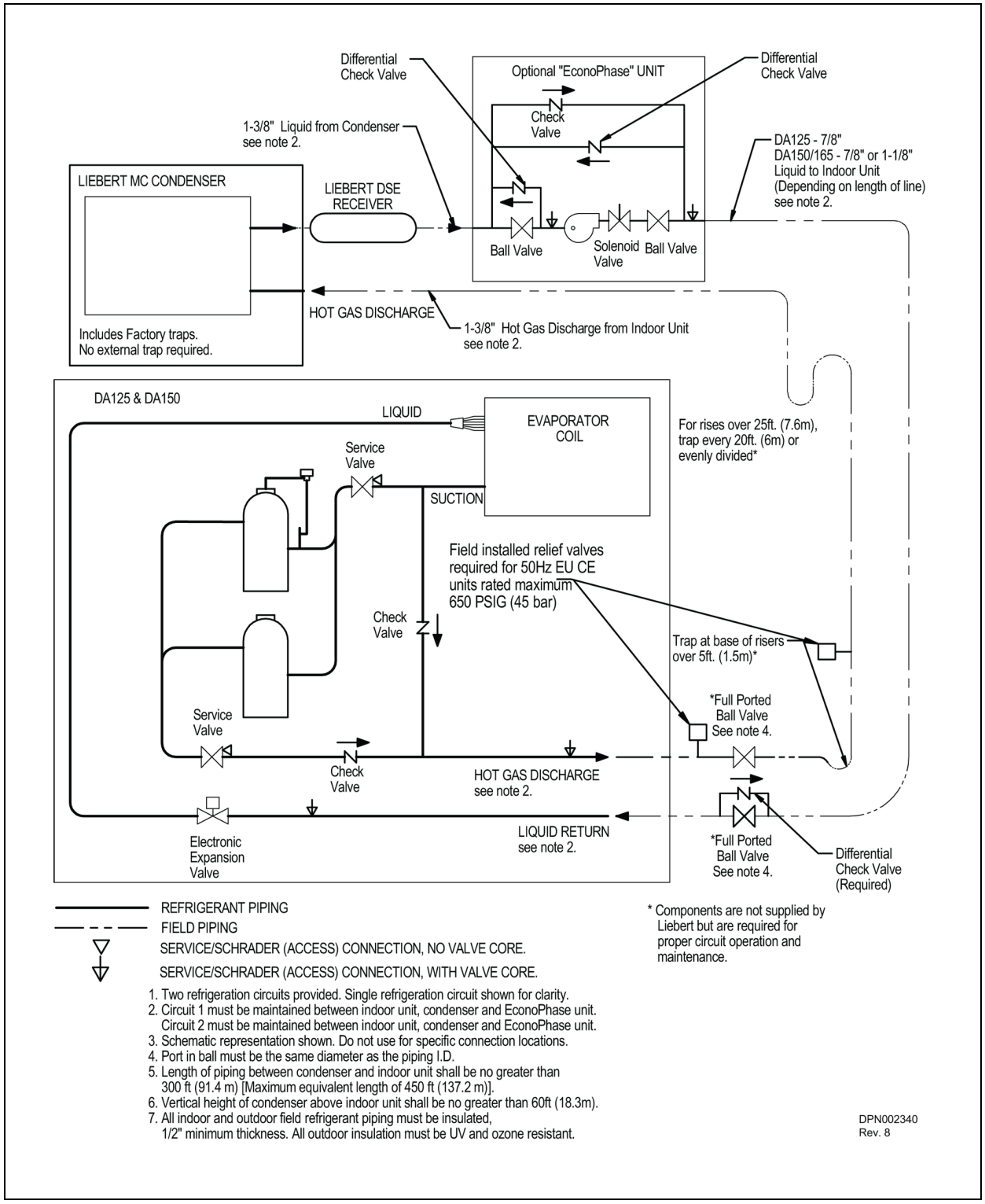


Figure 5.6 Piping schematic—Liebert DSE™, air-cooled DA125, DA150 and DA165 models



5.2 Field Piping Guidelines

One discharge line and one liquid line must be field-installed for each circuit of the indoor unit and the outdoor condenser(s). Dual circuit condensers are available for most dual circuit indoor unit applications. Refer to Figure 5.1 on page 55 throughCondenser piping for single-circuit condensers (with Liebert Lee-Temp™) on page 63 for additional field-installed piping needed at the condenser. This piping is needed for proper system performance and for installation/interconnecting receivers and head pressure control valves for Liebert Lee-Temp™ systems.

NOTE: Keep the evaporator unit and condenser closed with their factory charge of inert gas while all field piping is installed. Keep the field piping clean and dry during installation, and do not allow it to stand open to the atmosphere.

When all the field interconnecting piping is in place, vent the condenser's inert gas charge and connect to the field piping. Finally, vent the evaporator unit's charge of inert gas and make its piping connection last.

Follow all proper brazing practices, including a dry nitrogen purge to maintain system cleanliness.

The condenser connection pipes must be wrapped with a wet cloth to keep the pressure and temperature sensors cool during any brazing.

5.2.1 Field Piping Guidelines for a Liebert DX System and Liebert MC Condenser

Figure 5.7 Liebert MC Condenser piping—Single-circuit, 1-, 2-, 3- and 4-fan units

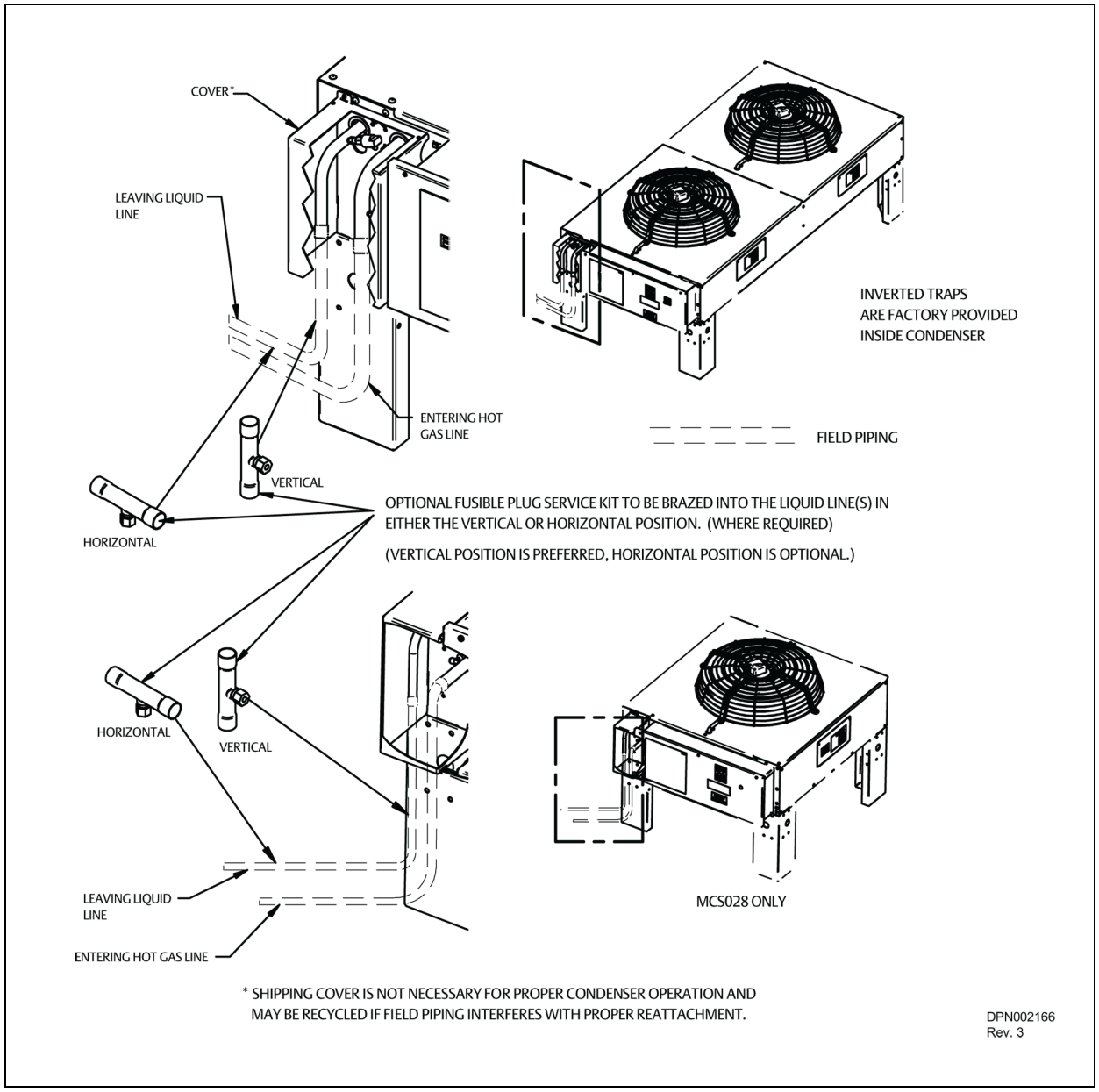


Table 5.1 Liebert MC Condenser piping sizes—Single-circuit units

Model No.	Number of Fans	Condenser Circuits	Connection Sizes, OD, in (mm)	
			Hot Gas Line	Liquid Line
MCS028	1	1	7/8	5/8
MCM040	1	1	7/8	5/8
MCM080	2	1	1-1/8	7/8

Table 5.1 Liebert MC Condenser piping sizes—Single-circuit units (continued)

Model No.	Number of Fans	Condenser Circuits	Connection Sizes, OD, in (mm)	
			Hot Gas Line	Liquid Line
MCL055	1	1	1-1/8	7/8
MCL110	2	1	1-3/8	1-1/8
MCL165	3	1	1-3/8	1-1/8
MCL220	4	1	1-5/8	1-3/8
Source: DPN002166, Rev. 3				

Figure 5.8 Condenser piping for single-circuit condensers (with Liebert Lee-Temp™)

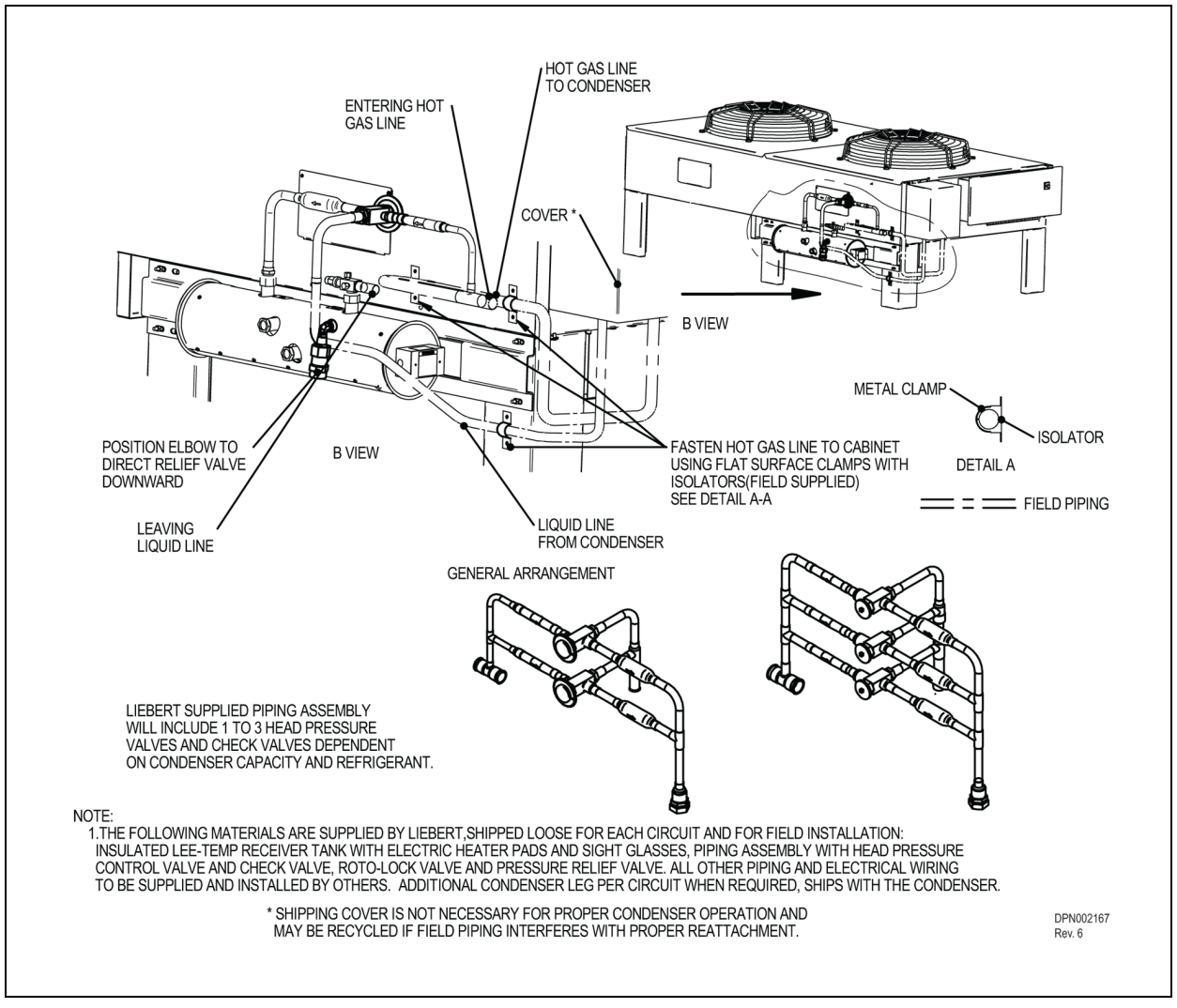


Table 5.2 Condenser piping connection sizes—Single-circuit condensers with Liebert Lee-Temp

Model #	Condenser Connections, OD, In		Liebert Lee-Temp Connections		
	Hot Gas	Liquid	Hot Gas Tee IDS, In.	Liquid Line to Liebert Lee-Temp Valve, ODS, In.	Receiver Out Rotalock, IDS, In.
MCS028	7/8	5/8	7/8	5/8	5/8
MCM040	7/8	5/8	7/8	5/8	5/8
MCM080	1-1/8	7/8	1-1/8	7/8	1-1/8
MCL055	1-1/8	7/8	1-1/8	7/8	7/8
MCL110	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8
MCL165	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8
MCL220	1-5/8	1-3/8	1-5/8	1-3/8	1-3/8
Source: DPN002167, Rev. 6					

Figure 5.9 Piping: dimensions—Dual circuit two-fan and four-fan units

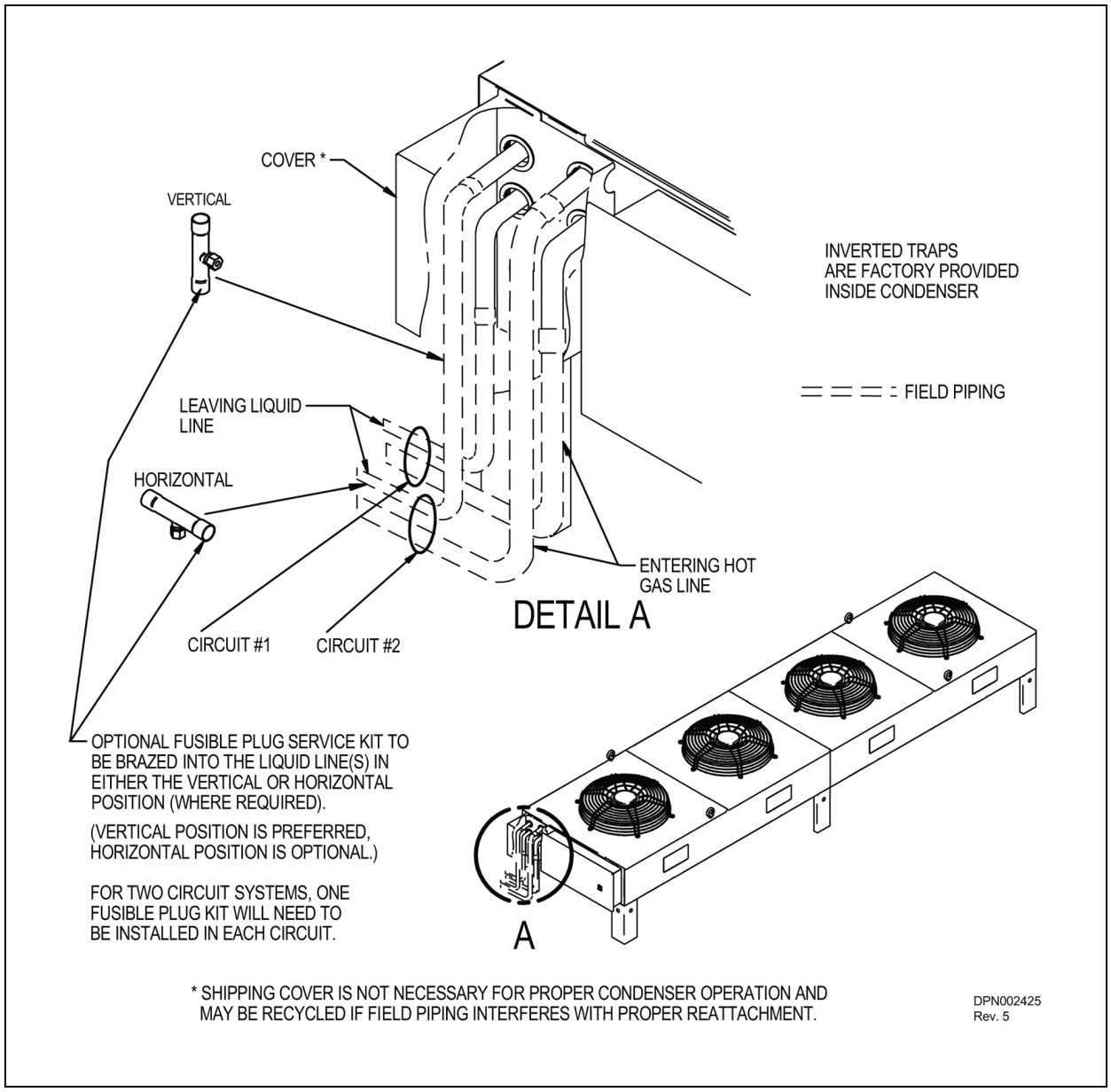


Table 5.3 Piping: dimensions—Dual-circuit, two-fan and four-fan units

Model #	Number of Fans	Condenser Circuits	Connection Sizes, OD, in	
			Hot Gas Line	Liquid Line
MCS056	2	2	7/8	5/8
MCM080	2	2	7/8	5/8
MCL110	2	2	1-1/8	7/8

Table 5.3 Piping: dimensions—Dual-circuit, two-fan and four-fan units (continued)

Model #	Number of Fans	Condenser Circuits	Connection Sizes, OD, in	
			Hot Gas Line	Liquid Line
MCM160	4	2	1-1/8	7/8
MCL220	4	2	1-3/8	1-1/8
Source: DPN002425, Rev. 5				

Figure 5.10 Piping: Dimensions with Liebert Lee-Temp™—Dual circuit condensers

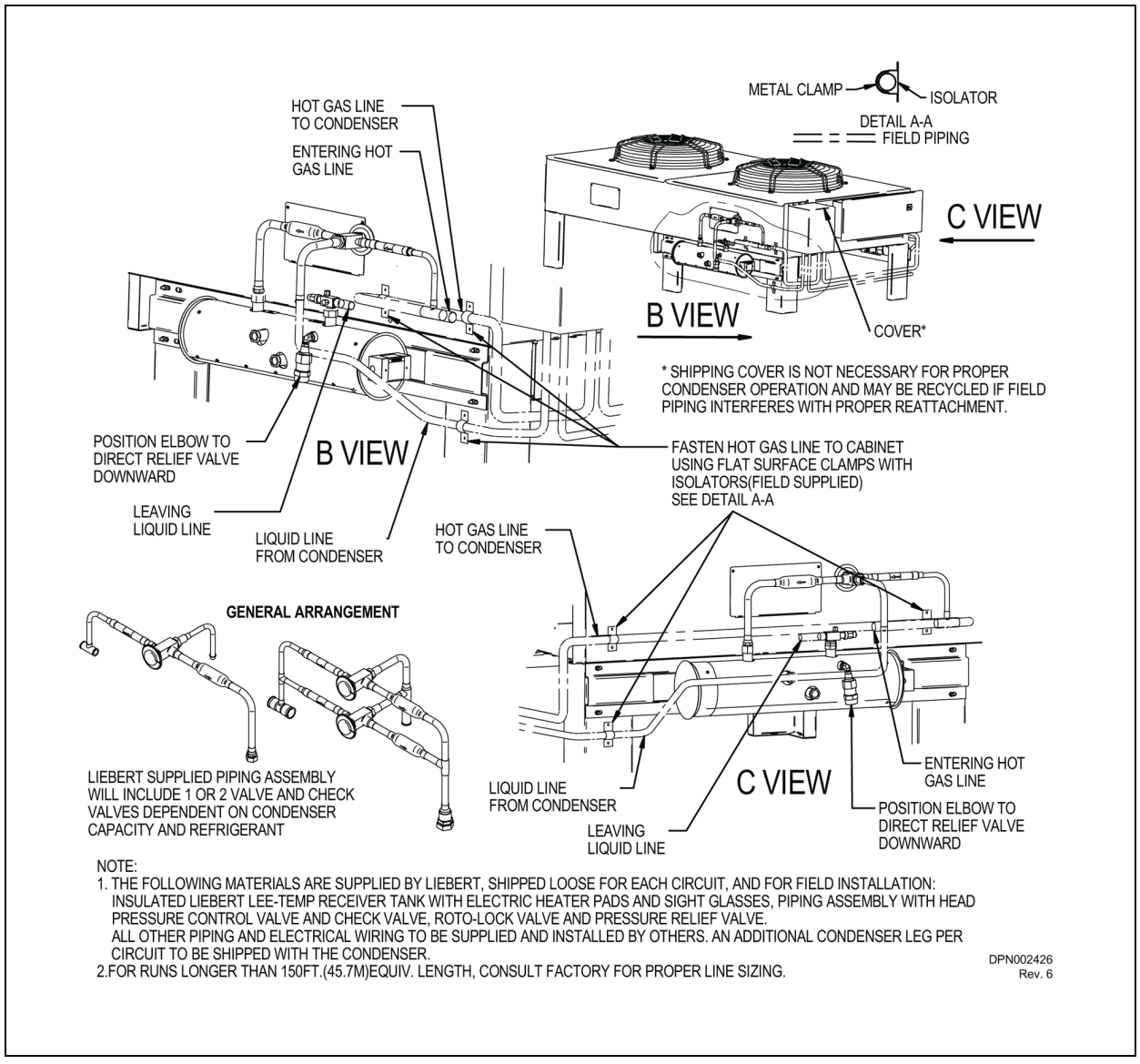


Table 5.4 Condenser piping connection sizes—Dual-circuit condensers with Liebert Lee-Temp

Model #	Condenser Connections, OD.In			Liebert Lee-Temp Connections		
	Condenser Circuits	Hot Gas	Liquid	Hot Gas Tee IDS In.	Liquid Line to Lee-Temp Valve ODS, In.	Receiver Out Rotalock IDS In.
MCS056	2	7/8	5/8	7/8	5/8	5/8
MCM080	2	7/8	5/8	7/8	5/8	5/8
MCL110	2	1-1/8	7/8	1-1/8	7/8	78
MCL160	2	1-1/8	7/8	1-1/8	7/8	1-1/8
MCL220	2	1-3/8	1-1/8	1-3/8	1-1/8	1-1/8
Source: DPN002426, Rev. 6						

5.2.2 Field Piping Guidelines for a Liebert DSE and Liebert Premium MC Condenser

Figure 5.11 Condenser and Liebert EconoPhase™, typical unit arrangement diagram layout for dual-circuit system

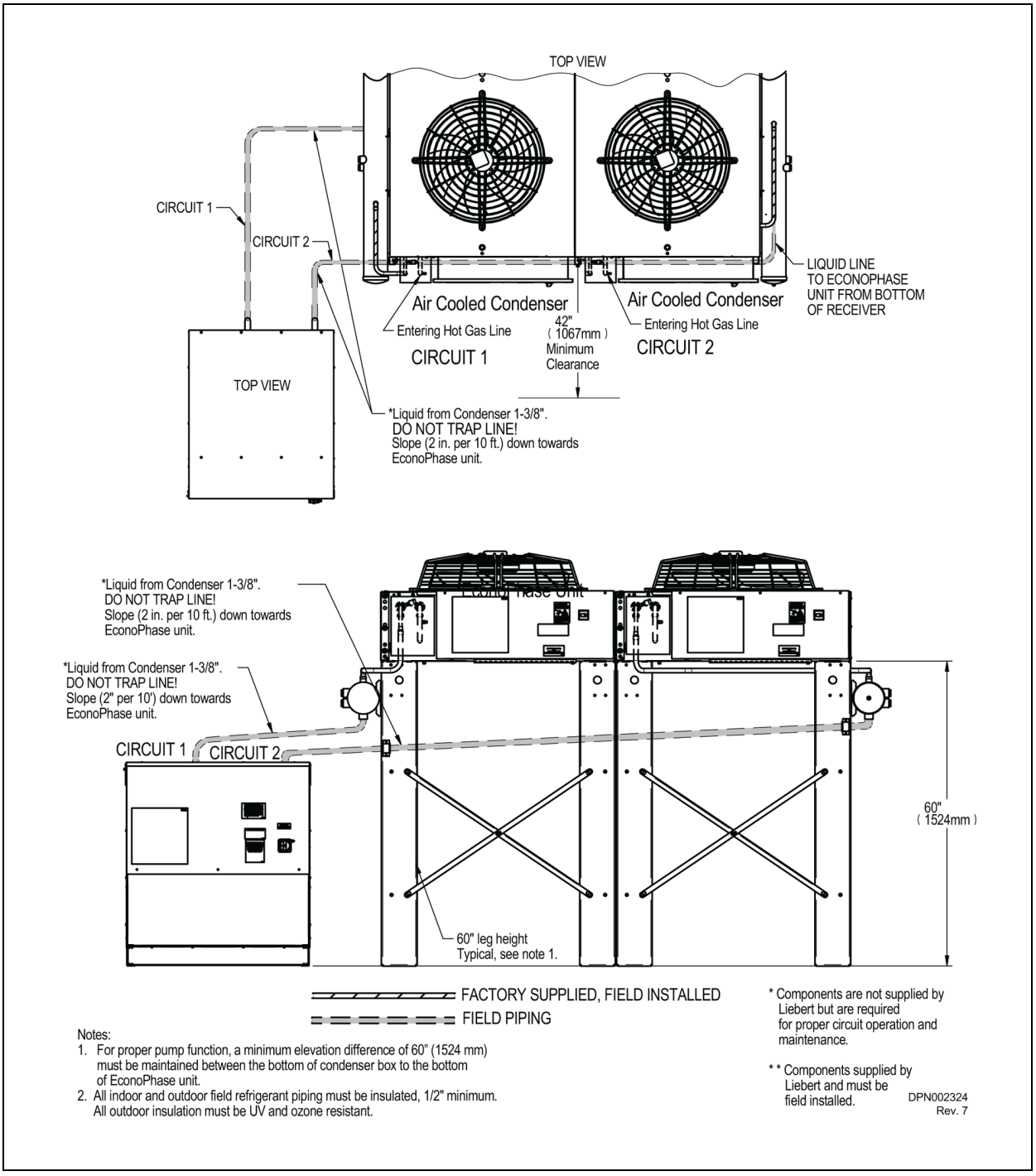


Figure 5.12 Condenser and Liebert EconoPhase™, typical unit arrangement diagram layout for single-circuit system

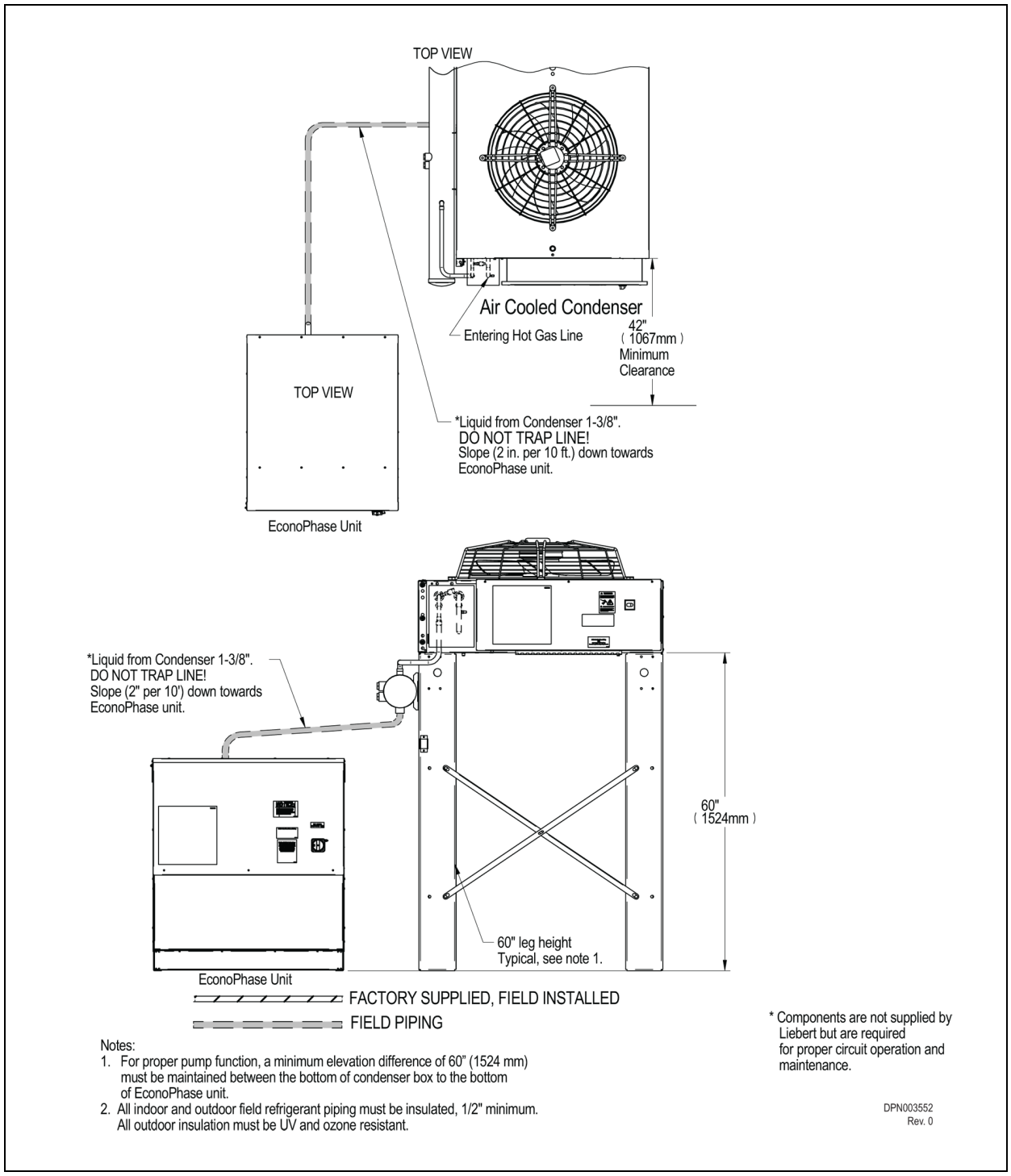
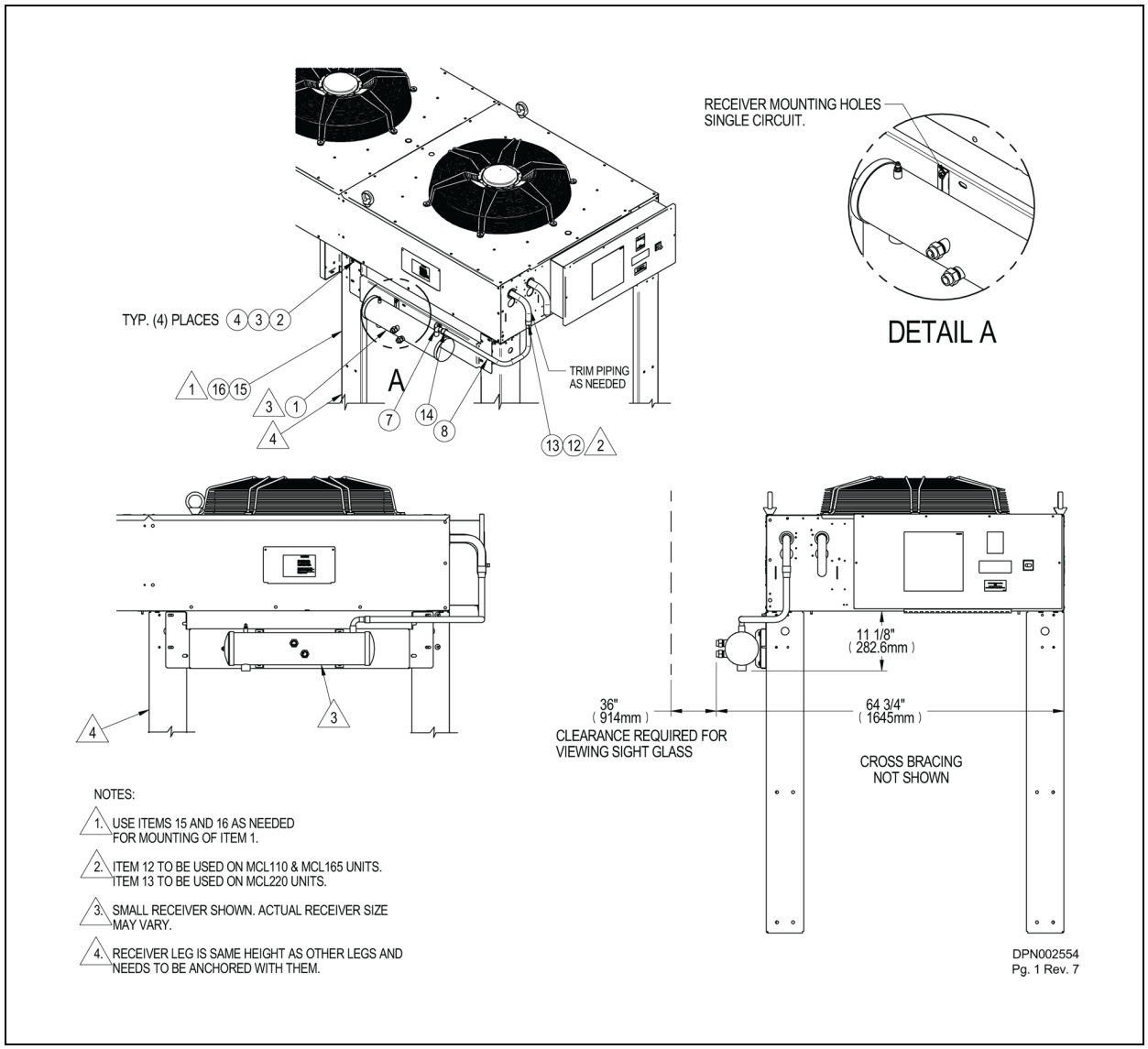


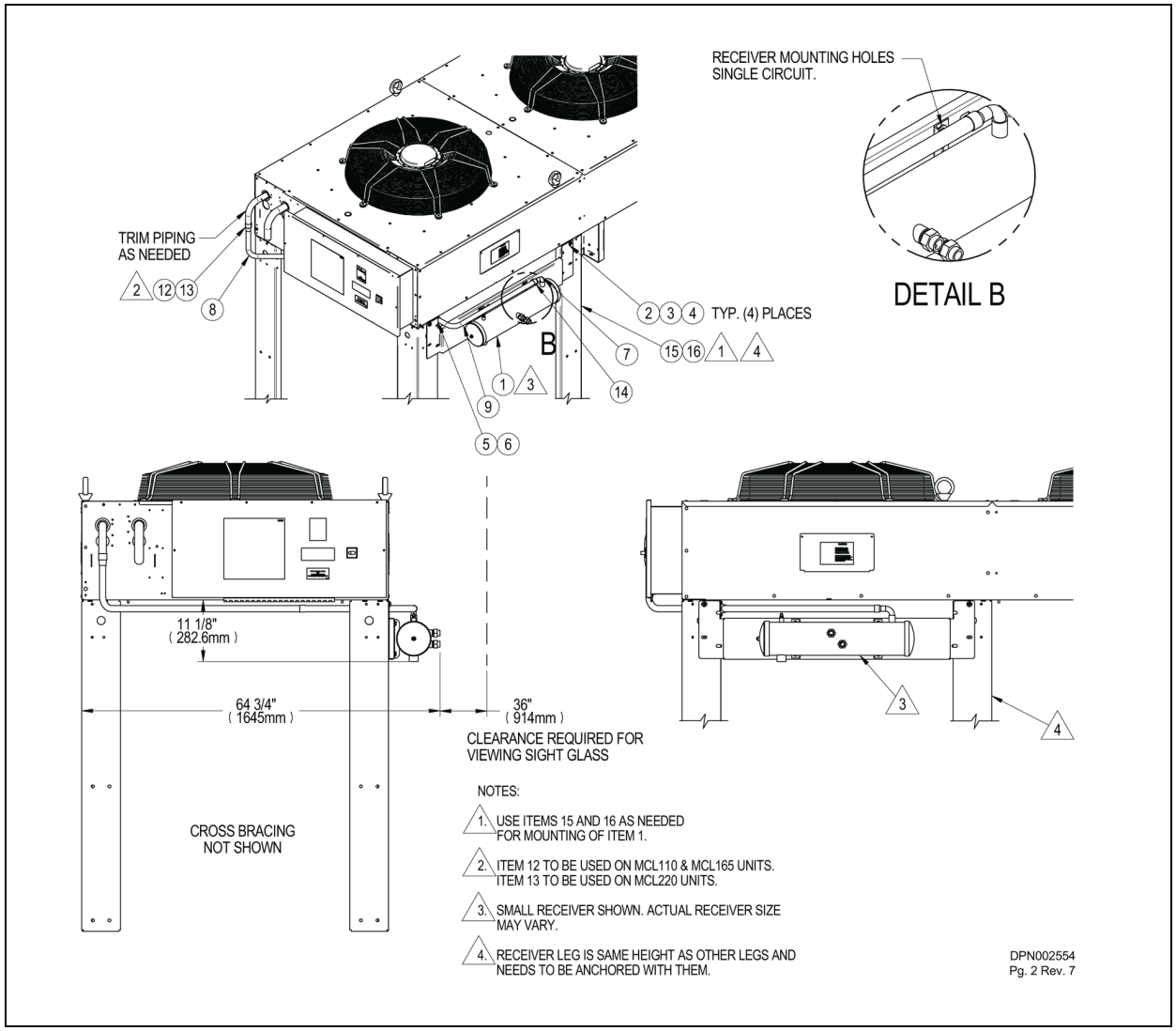
Figure 5.13 Typical receiver Liebert DSE mounting, MCL110, MCL165 and MCL220 single-circuit condenser, left-side condenser outlet receiver



Item No.	Description	Qty
1	Receiver and Bracket Assembly	1
2	Cap Screw HXDIN933M8-1.25X25A2	8
3	Fender Washer DIN9021 M8X24 A2	12
4	Lock Nut Hex NYL INSR M8	8
7	90° Elbow FTGXFTG 7/8” Copper	1
8	Copper Formed Tube 1-1/8”	1
12	Coupling Copper 1-1/8”	1
13	Reducer Copper CXC 1-3/8”x1-1/8”	1

Item No.	Description	Qty
14	Reducer Copper CXC 1-1/8”x7/8”	1
15	Support Leg	1
16	Fastener Assembly: Cap Screw, Lock Washer, Fender Washer	4

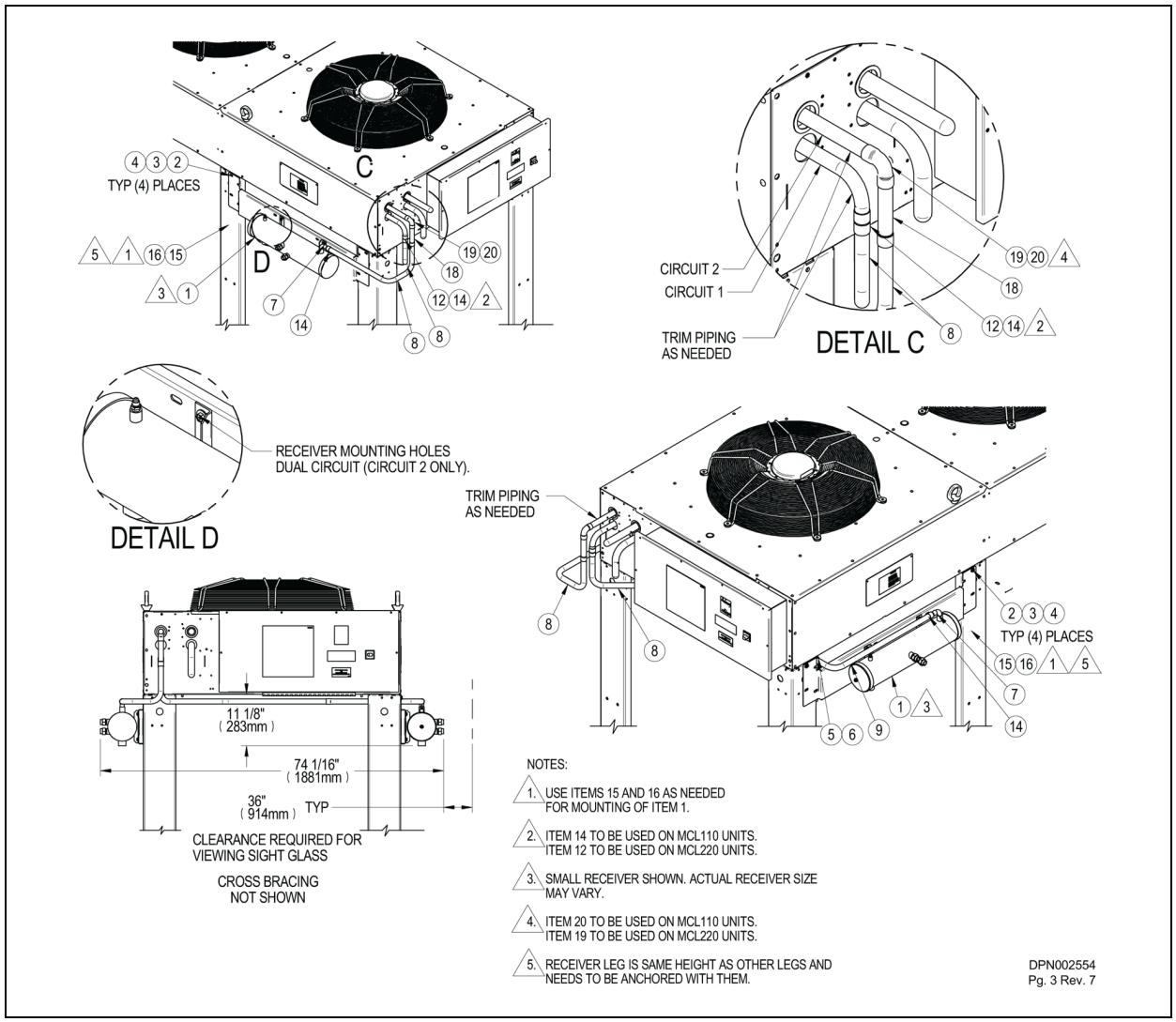
Figure 5.14 Typical receiver Liebert DSE mounting, MCL110, MCL165 and MCL220 single-circuit condenser, right-side condenser outlet receiver



Item No.	Description	Qty
1	Receiver and Bracket Assembly	1
2	Cap Screw HXDIN933M8-1.25X25A2	8
3	Fender Washer DIN9021 M8X24 A2	12
4	Lock Nut Hex NYL INSR M8	8
5	Clamp Omega 7/8”	7
6	Screw SD HWH YZ 10-16 x 5/8	2

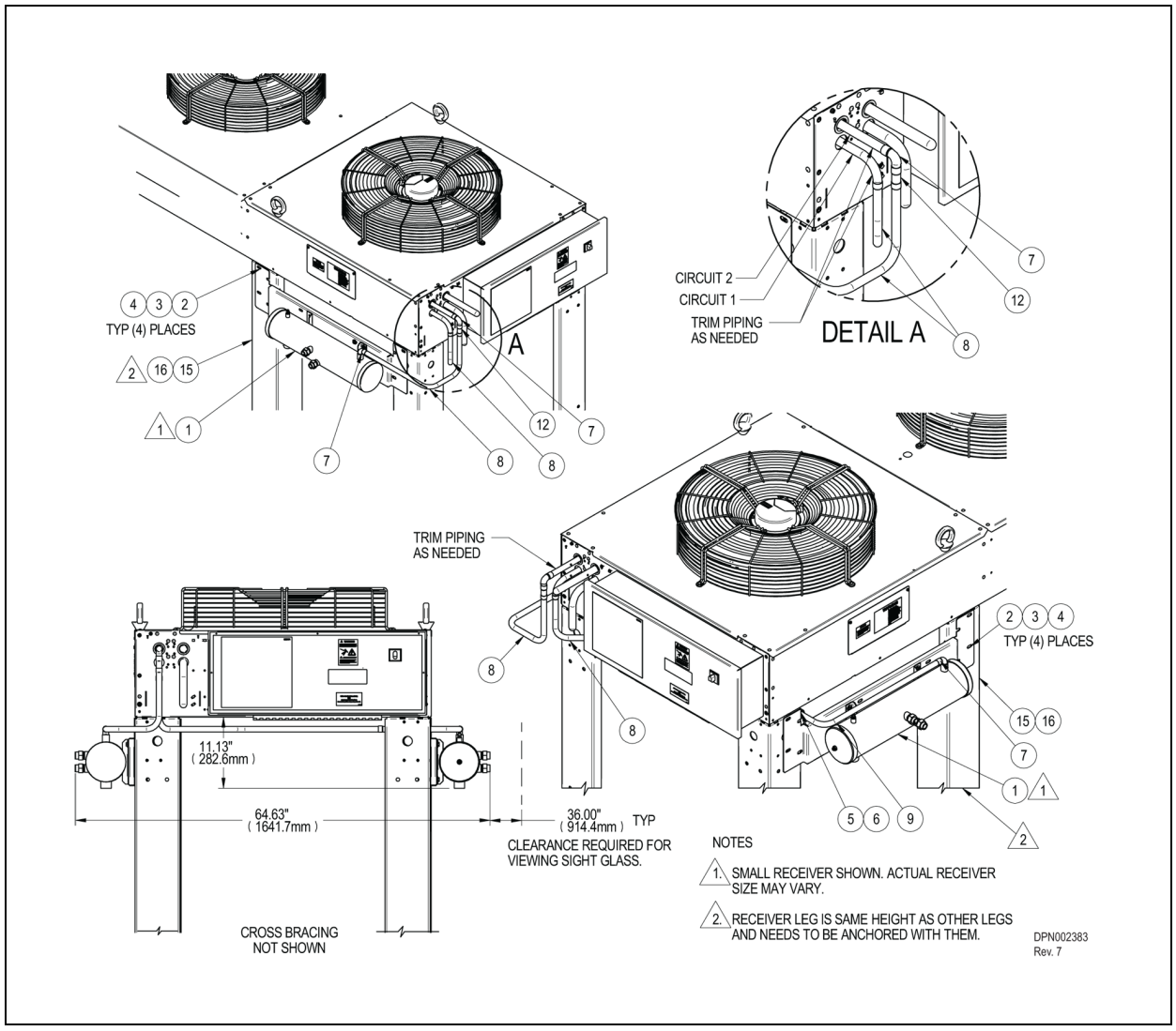
Item No.	Description	Qty
7	90° Elbow FTGXFTG 7/8” CU	1
8	Copper Formed Tube 1-1/8”	1
9	Copper Formed Tube 1-1/8”	2
12	Coupling Copper 1-1/8”	1
13	Reducer Copper CXC 1-3/8”x1-1/8”	1
14	Reducer Copper CXC 1-1/8”x7/8”	2
15	Support Leg	1
16	Fastener Assembly: Cap Screw, Lock Washer, Fender Washer	4

Figure 5.15 Typical receiver Liebert DSE mounting, MCL110 and MCL220 dual-circuit condenser, two outlet receivers



Item No.	Description	Qty
1	Receiver and Bracket Assembly	2
2	Cap Screw HXDIN933M8-1.25X25A2	12
3	Fender Washer DIN9021 M8X24 A2	20
4	Lock Nut Hex NYL INSR M8	12
5	Clamp Omega 7/8”	1
6	Screw SD HWH YZ 10-16 x 5/8	2
7	90° Elbow FTGXFTG 7/8” Copper	2
8	Copper Formed Tube 1-1/8”	2
9	Copper Formed Tube 1-1/8”	1
12	Coupling Copper 1-1/8”	1
14	Reducer Copper CXC 1-1/8”x7/8”	3
15	Support Leg	2
16	Fastener Assembly: Cap Screw, Lock Washer, Fender Washer	8
18	Copper Tube 1-1/8” Swaged	1
19	90° Elbow CXC 1-1/8” Copper	1
20	90° Elbow CXC 1-1/8”X7/8” Copper	1

Figure 5.16 Typical receiver Liebert DSE mounting, MCM160 dual-circuit condenser, two outlet receivers



Item No.	Description	Qty
1	Receiver and Bracket Assembly	2
2	Cap Screw HXDIN933M8-1.25X25A2	12
3	Fender Washer DIN9021 M8X24 A2	20
4	Lock Nut Hex NYL INSR M8	12
5	Clamp Omega 7/8”	1
6	Screw SD HWH YZ 10-16 x 5/8	2
7	90° Elbow FTGXC 7/8” Copper	3
8	Copper Formed Tube 7/8”	2
9	Copper Formed Tube 7/8”	1

Item No.	Description	Qty
12	Copper Tube 7/8" Swaged	1
15	Support Leg	1
16	Fastener Assembly: Cap Screw, Lock Washer, Fender Washer	4

5.3 Refrigerant Planning Values

Planning for the refrigerant requirements of the completed system is the total of the charges from Indoor Unit, Condenser (including Liebert Lee-Temp™ receiver, if used) and the interconnecting piping. Table 5.5 below, Table 5.6 on the next page, Table 5.8 on page 78 and Table 5.9 on page 80 provide the approximate charge required for the condensers, recommended refrigerant pipe sizes and the interconnecting piping. Consult indoor unit manuals for indoor unit charge requirements.

These values can be used for obtaining adequate refrigerant for the system, but should not be used for final charging.

NOTE: Due to the much smaller coil volume, the performance, especially subcooling, of a LiebertMC condenser is quite sensitive to the amount of refrigerant charge. Ensure that an accurate amount of refrigerant charge is added.

Table 5.5 Refrigerant required, R-407C, approximate

Condenser Models	Single Circuit, lb/circuit (kg/circuit)		Dual Circuit, lb/circuit (kg/circuit)	
Approximate R-407C Refrigerant Needed	Condensers without Liebert Lee-Temp	Condensers with Liebert Lee-Temp	Condensers without Liebert Lee-Temp	Condensers with Liebert Lee-Temp
MCS028	2.2 (1.0)	23.1 (10.5)	—	—
MCS056	N/A	N/A	2.2 (1.0)	23.1 (10.5)
MCM040	3.0 (1.4)	23.9 (10.8)	N/A	N/A
MCM080	7.5 (3.4)	44.5 (20.2)	3.0 (1.4)	23.9 (10.8)
MCM160	—	—	7.5 (3.4)	44.5 (20.2)
MCL055	5.0 (2.3)	25.9 (11.7)	—	—
MCL110	10.5 (4.8)	52.1 (23.7)	5.1 (2.3)	26.0 (11.8)
MCL165	18.3 (8.3)	84.8 (38.5)	—	—
MCL220	27.0 (12.3)	108.9 (49.4)	12.2 (5.6)	53.8 (24.4)
Source: DPN002411, Rev. 7				

Table 5.6 Refrigerant required, R-410A, approximate

Condenser Models	Single Circuit, lb/circuit (kg/circuit)			Dual Circuit, lb/circuit (kg/circuit)		
	Condensers w/o Liebert Lee-Temp	Condensers with Liebert Lee-Temp	Condensers withLiebert DSE Small Receiver/ Large Receiver[1]	Condensers w/o LiebertLee-Temp	Condensers withLiebert Lee-Temp	Condenserswith Liebert DSE Small Receiver/ Large Receiver[1]
MCS028	2.5 (1.2)	21.7 (9.8)	—	—	—	—
MCS056	—	—	—	2.5 (1.2)	21.7 (9.8)	—
MCM040	3.5 (1.6)	22.7 (10.3)	—	—	—	—
MCM080	8.5 (3.8)	39.8 (18.1)	17.0 (7.7)	3.5 (1.6)	22.7 (10.3)	—
MCM160	—	—	—	8.5 (3.8)	39.8 (18.1)	17 (7.7) / 24 (10.9)
MCL055	5.0 (2.3)	24.2 (11.0)	—	—	—	—
MCL110	10.7 (4.9)	49.1 (22.3)	19.2 (8.7)	5.2 (2.4)	24.4 (11.1)	13.7 (6.2)
MCL165	18.4 (8.4)	79.9 (36.2)	26.9 (12.2)/ 33.9 (15.4)	—	—	—
MCL220	27.0 (12.3)	102.9 (46.7)	42.5 (19.3)	12.3 (5.6)	50.7 (23.0)	20.8 (9.4) / 27.8 (12.6)

1. Small receiver is used with DA050, DA080 and DA085; large receiver is used with DA125, DA150 and DA165.

Source: DPN002411, Rev. 7

5.3.1 Recommended Refrigerant Line Sizes

Table 5.7

Recommended Refrigerant Line Sizes, OD Cu

System Fluid : R-410A		Standard and Digital Scroll Models				
Model	Equivalent Length, in.	50 ft (15m)	100 ft (30m)	150 ft (45m)	300 ft (91m)	450ft (137m)
CR019RA/ CR020RA	Hot Gas Line	3/4	3/4	3/4	7/8[1]	—
	Liquid Line	5/8	5/8	5/8	3/4	—
CR035RA	Hot Gas Line	7/8	7/8	7/8	1-1/8[1]	—
	Liquid Line	3/4	3/4	3/4	7/8	—
PX011	Hot Gas Line	1/2	5/8[1]	5/8[1]	5/8[1]	—
	Liquid Line	3/8	1/2	1/2	1/2	—
PX018	Hot Gas Line	5/8	5/8	5/8	3/4[1]	—
	Liquid Line	1/2	1/2	1/2	5/8	—
PX023	Hot Gas Line	3/4	3/4	3/4	7/8[1]	—
	Liquid Line	5/8	5/8	5/8	5/8	—
PX029	Hot Gas Line	7/8	7/8	7/8	1-1/8[1]	—
	Liquid Line	5/8	5/8	5/8	3/4	—
DA050/ DA080/ DA085	Hot Gas Line	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8
	Liquid Line	7/8	7/8	7/8	7/8	7/8

Table 5.7 Recommended Refrigerant Line Sizes, OD Cu (continued)

System Fluid : R-410A		Standard and Digital Scroll Models					
Model	Equivalent Length, in.	50 ft (15m)	100 ft (30m)	150 ft (45m)	300 ft (91m)	450ft (137m)	
DA125	Hot Gas Line	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	
	Liquid Line	7/8	7/8	7/8	7/8	7/8	
DA150	Hot Gas Line	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	
	Liquid Line	7/8	1-1/8[2]	1-1/8[2]	1-1/8	1-1/8	
DA165	Hot Gas Line	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	
	Liquid Line	7/8	1-1/8[2]	1-1/8[2]	1-1/8	1-1/8	
System Fluid : R-407C		**Standard Scroll Models (Non-Digital Scroll)**			**4-Step Semi-Hermetic or Digital Scroll Models**		
Model	**Equivalent Length, in.**	**50 ft (15m)**	**100 ft (30m)**	**150 ft (45m)**	**50 ft (15m)**	**100 ft (30m)**	**150 ft (45m)**
DS028	Hot Gas Line	7/8	7/8	7/8	3/4	3/4	7/8
	Liquid Line	1/2	5/8	5/8	1/2	5/8	5/8
DS035	Hot Gas Line	7/8	7/8	7/8	3/4	7/8	7/8
	Liquid Line	1/2	5/8	5/8	1/2	5/8	5/8
DS042	Hot Gas Line	7/8	7/8	7/8	7/8	7/8	1-1/8[1]
	Liquid Line	1/2	5/8	5/8	5/8	5/8	5/8
DS053	Hot Gas Line	7/8	1-1/8	1-1/8	7/8	1-1/8[1]	1-1/8[1]
	Liquid Line	5/8	7/8	7/8	7/8	7/8	7/8
DS070	Hot Gas Line	1-1/8	1-1/8	1-1/8	1-1/8[1]	1-1/8[1]	1-1/8[1]
	Liquid Line	7/8	7/8	7/8	7/8	7/8	7/8
DS077[3]	Hot Gas Line	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8	1-1/8
	Liquid Line	7/8	7/8	7/8	7/8	7/8	7/8
DS105[3]	Hot Gas Line	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8	1-3/8
	Liquid Line	7/8	7/8	1-1/8	7/8	7/8	7/8

Consult factory for proper line sizing for R-410A DX-only system-piping runs longer than 300 ft. (91.4 m), R410A Liebert DSE system piping runs longer than 450 ft. (137 m), or R407-C runs longer than 150 ft. (45.7 m) equivalent length.

1. Downsize vertical riser one trade size (1-1/8" to 7/8" or 7/8" to 3/4" or 5/8" to 1/2").
2. When the vertical elevation between the indoor DA150/165 unit exceeds 25 ft., the liquid-line pipe diameter can be 7/8".
3. Digital scroll not available on 077 and 105 models.

Table 5.8 Interconnecting piping refrigerant charge for self-contained DX units with remote condenser

Line Size O.D., in.	R-407C, lb/100ft. (kg/30m)		R-410A, lb/100ft. (kg/30m)	
	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
3/8	—	3.6 (1.6)	—	3.2 (1.4)
1/2	0.5 (0.2)	6.7 (3.0)	0.7 (0.3)	5.9 (2.7)
5/8	0.8 (0.4)	10.8 (4.8)	1.1 (0.5)	9.6 (4.3)
3/4	1.2 (0.5)	16.1 (7.2)	1.6 (0.7)	14.3 (6.4)
7/8	1.7 (0.8)	22.3 (10.0)	2.3 (1.0)	19.8 (8.8)
1-1/8	2.9 (1.3)	38.0 (17.0)	3.9 (1.7)	33.8 (15.1)
1-3/8	4.4 (2.0)	57.9 (25.9)	5.9 (2.6)	51.5 (23.0)
1-5/8	6.2 (2.8)	—	8.4 (3.7)	—

1. Data based on 50°F Evap 15°F superheat 125°F SCT 10°F subcooling
2. Source: DPN003099, Rev. 0

5.4 Equipment Application Guidelines

Pump-down must be disabled on the indoor unit when using the Liebert MC condenser, due to the reduced volume in the condenser coil.

Vertiv™ recommends adding a discharge line check valve and crankcase heater when connecting the Liebert MC condenser to Liebert indoor units built before 2012. The check valve and crankcase heater are needed for compressor protection. Additional liquid line Schrader ports are required at the indoor unit to properly charge systems with Liebert MC condensers.

5.5 Refrigerant Oil Addition Procedures

Consult the user manual for the indoor unit to determine whether additional oil is required for each circuit. Factors such as compressor, condenser type, piping lengths, receiver and total circuit refrigerant charge influence this requirement.

5.6 System Dehydration/Leak Test

Procedures for leak check and evacuation of the entire refrigeration system are contained in the indoor unit's installation manual. Use the proper manual section corresponding to the winter control system used on the condenser (with or without Liebert Lee-Temp™ or Liebert DSE™ receivers) and the refrigerant to be charged into the system.

5.7 System Charging with Liebert MC

5.7.1 Liebert MC Charging, Units with Liebert Lee-Temp™ Receivers

Consult the indoor unit's manual for charging systems with Liebert Lee-Temp receivers. These procedures will be identical to systems with fin/tube condenser coils, but the refrigerant volumes will be much lower. Consult Table 5.5 on page 75 and Table 5.6 on page 76 for refrigerant required by a condenser with Liebert Lee-Temp.

5.7.2 Liebert MC Condenser Charging with Liebert DSE™ Receivers

Consult the Liebert DSE manual (SL-18925) for charging Liebert DSE systems. All Liebert DSE require installation of a Liebert DSE receiver on each condenser circuit, with or without a Liebert EconoPhase pump module installed. Consult Table 5.6 on page 76 for condenser and receiver refrigerant requirements.

5.7.3 Liebert MC Charging, Premium Efficiency Control, Units without Receivers

Source: DPN002411, Rev. 7

Liebert MC condensers are charge-sensitive and require accurate calculation of the system charge to avoid overcharging. To avoid overcharge, additional guidelines are recommended to ensure trouble-free operation.

- When charging system in an outdoor ambient below 50°F (10°C), recheck the subcooling against Table 5.10 on the next page when the ambient temperature is above 60°F (15.6°C)
- The indoor space should be maintained at 70-80°F (21-26.7°C) return air before final charge adjustments are made.
- Charging a unit at temperatures above 80°F (26.7°C) return air may result in the unit being overcharged.
- Charge by subcooling measurement at the indoor unit. See Table 5.10 on the next page for target subcooling temperatures.
- Pressure and temperature measuring instruments should be capable of measuring to ±10 psig (68.9kPa) and ± 2°F (1.1°C) for best subcooling measurement.

1. Check the nameplate on the indoor unit for refrigerant type to be used. Unit control configurations differ depending on refrigerant type.
2. Refrigerant charging requires the unit to be in operation. Refer to the indoor unit's user manual for the *Checklist for Completed Installation*.
3. Calculate the amount of charge for the system. Refer to the indoor unit user manual, and condenser and refrigerant line charge data in the appropriate tables.
4. Weigh in as much of the system charge as possible before starting the unit.
   Do not exceed the calculated charge by more than 0.5 lb. (0.23kg).

NOTICE

Risk of improper refrigerant charging. Can cause equipment damage.

Refrigerant R-407C and R-410A are blended refrigerants and must be introduced and charged from the cylinder only as a liquid.

When adding liquid refrigerant to an operating system, it may be necessary to add the refrigerant through the compressor suction service valve. Care must be exercised to avoid damage to the compressor.

Vertiv™ recommends connecting a sight glass between the charging hose and the compressor suction service valve. This will permit adjusting the cylinder hand valve so that liquid can leave the cylinder while allowing vapor to enter the compressor.

NOTICE

Risk of refrigerant overcharge. Can cause equipment damage.

Do not use the sight glass as an indicator when charging Liebert MC condenser systems.

5. Turn On the Liebert MC disconnect switch.
6. Turn on the indoor unit disconnect switch. Operate the unit for 30 minutes using the charging function of the indoor-unit control for each circuit of the system. The charging function is in the diagnostic section of Liebert iCOM® (see Liebert iCOM user manual, SL-18847, available at www.VertivCo.com.

   The charging function operates the compressor(s) at full capacity and energizes the liquid line solenoid valve(s). The reheat and humidifier are disabled. Manual operation of the indoor fans from the diagnostic menu of Liebert iCOM is required. A minimum 20psig (138kPa) must be established and maintained for the compressor to operate. The charging function can be reset as many times as required to complete unit charging.

Table 5.9 Charge amounts per 100 ft. (30m) of pipe by line size

Line Size O.D., in.	R-407C (R-22), lb/100 ft. (kg/30m)		R-410A, lb/100 ft. (kg/30m)	
	Hot Gas Line	Liquid Line	Hot Gas Line	Liquid Line
3/8	—	3.6 (1.6)	—	3.2 (1.4)
1/2	0.5 (0.2)	6.7 (3.0)	0.7 (0.3)	5.9 (2.7)
5/8	0.8 (0.4)	10.8 (4.8)	1.1 (0.5)	9.6 (4.3)
3/4	1.2 (0.5)	16.1 (7.2)	1.6 (0.7)	14.3 (6.4)
7/8	1.7 (0.8)	22.3 (10.0)	2.3 (1.0)	19.8 (8.8)
1-1/8	2.9 (1.3)	38.0 (17.0)	3.9 (1.7)	33.8 (15.1)
1-3/8	4.4 (2.0)	57.9 (25.9)	5.9 (2.6)	51.5 (23.0)
1-5/8	6.2 (2.8)	—	8.4 (3.7)	—

Data based on 50°F Evap, 15°F superheat, 125°F SCT, 10°F subcooling.
Source: DPN002411, Rev. 7

7. Attach pressure and temperature instruments to the liquid line of the indoor unit. Measure the initial subcooling and continue to add charge until reaching the recommended subcooling for the current outdoor ambient temperature (see Table 5.10 below). The outdoor ambient can be read from the Liebert MC condenser control menu ID F02.

NOTE: To determine subcooling measurement, a liquid line pressure reading (at the factory-installed Schrader tap) needs to be measured along with obtaining a temperature reading on the liquid line. Convert the liquid line pressure reading into a temperature by utilizing a Pressure-Temperature Guide or Table 5.11 on the facing page. The difference between this converted temperature and the actual temperature will determine the system's subcooling. For R-407C make sure to use the saturated liquid temperature to calculate subcooling.

Table 5.10 Target subcooling for ambient outdoor temperature

Ambient Temp °F (C°)	Subcooling °F (C°)
0 (-17.8)	22 (12.0)
10 (-12.2)	22 (12.0)
20 (-6.7)	22 (12.0)
30 (-1.1)	22 (12.0)

Table 5.10 Target subcooling for ambient outdoor temperature (continued)

Ambient Temp °F (C°)	Subcooling °F (C°)
40 (4.4)	22 (12.0)
50 (10.0)	21 (11.7)
60 (15.6)	19 (10.8)
70 (21.1)	17 (9.3)
80 (26.7)	13 (7.2)
90 (32.2)	9 (5.0)
95 (35.0)	7 (3.9)
100 (37.8)	5 (2.9)
105 (40.6)	3 (1.8)
110 (43.3)	1 (0.7)
125 (51.7)	0
DPN002411, Rev. 7	

8. As head pressure builds, the variable fan speed controlled condenser fan begins rotating. The fan will run at full speed when sufficient head pressure is developed.

Table 5.11 Liquid pressures and temperatures

Pressure Psig (Bar)	R407C[1] °F (°C)	R410A[1] °F (°C)	R22 °F (°C)
170 (11.7)	81.5 (27.5)	59.8 (15.4)	90.6 (32.6)
180 (12.4)	85.1 (29.5)	63.1 (17.3)	94.3 (34.6)
190 (13.1)	88.6 (31.5)	66.3 (19.1)	97.9 (36.6)
200 (13.8)	92.0 (33.3)	69.5 (20.8)	101.4 (38.6)
210 (14.5)	95.2 (35.1)	72.5 (22.5)	104.7 (40.4)
220 (15.2)	98.3 (36.8)	75.4 (24.1)	108.0 (42.2)
230 (15.9)	101.4 (38.5)	78.2 (25.7)	111.1 (44.0)
240 (16.6)	104.3 (40.2)	80.9 (27.2)	114.2 (45.7)
250 (17.2)	107.2 (41.8)	83.6 (28.7)	117.1 (47.3)
260 (17.9)	109.9 (43.3)	86.2 (30.1)	120.0 (48.9)
270 (18.6)	112.6 (44.8)	88.7 (31.5)	122.8 (50.4)
280 (19.3)	115.3 (46.3)	91.1 (32.8)	125.5 (52.0)
290 (20.0)	117.8 (47.7)	93.5 (34.2)	128.2 (53.4)
300 (20.7)	120.3 (49.1)	95.8 (35.5)	130.8 (54.9)
310 (21.4)	122.8 (50.4)	98.1 (36.7)	133.3 (56.3)
320 (22.1)	125.2 (51.8)	100.3 (38.0)	135.8 (57.7)
330 (22.8)	127.5 (53.1)	102.5 (39.2)	138.2 (59.0)
340 (23.4)	129.8 (54.3)	104.6 (40.3)	140.6 (60.3)
350 (24.1)	132.1 (55.6)	106.7 (41.5)	142.9 (61.6)
360 (24.8)	134.3 (56.8)	108.7 (42.6)	145.2 (62.9)
370 (25.5)	136.4 (58.0)	110.7 (43.7)	147.4 (64.1)
380 (26.2)	138.6 (59.2)	112.7 (44.8)	149.6 (65.4)

Table 5.11 Liquid pressures and temperatures (continued)

Pressure Psig (Bar)	R407C[1] °F (°C)	R410A[1] °F (°C)	R22 °F (°C)
390 (26.9)	140.6 (60.3)	114.5 (45.9)	151.8 (66.5)
400 (27.6)	142.7 (61.5)	116.4 (46.9)	153.9 (67.7)
500 (34.5)	161.3 (71.8)	133.5 (56.4)	173.1 (78.4)
600 (41.4)	177.4 (80.8)	148.1 (64.5)	189.5 (87.5)

1. Values are for saturated liquid.
2. Source: DPN002411, Rev. 7

6 CHECKLIST FOR COMPLETED INSTALLATION

6.1 Moving and Placing Equipment

_____ 1. Unpack and check received material.

_____ 2. Proper clearance for service access has been maintained around the equipment.

_____ 3. Equipment is level and mounting fasteners are tight.

6.2 Electrical

_____ 1. Line voltage connected and matches equipment nameplate.

_____ 2. Power line circuit breakers or fuses have proper ratings for equipment installed.

_____ 3. Control wiring connections completed between indoor cooling unit and condenser.

_____ 4. All internal and external high-voltage and low-voltage wiring connections are tight to the proper torque ratings shown on the components.

_____ 5. Confirm that unit is properly grounded to an earth ground.

_____ 6. Electrical service conforms to national and local codes.

_____ 7. Monitoring wiring connections completed, when equipped, to indoor cooling unit or external monitoring panel.

_____ 8. Verify that the Premium EC fan condenser is not connected to a delta power supply.

_____ 9. Verify that the CANbus wiring, CANbus “END of Line” jumper position and the CANbus “Device Address DIP Switch” setting is correct according to the application at the job site.

_____ 10. Verify that Terminals 70, 71 and 230 (when applicable) are used and that they are properly wired, particularly on systems that use two condensers for one indoor unit.

6.3 Piping

_____ 1. Piping is completed to corresponding indoor cooling unit refrigeration circuit.

_____ 2. Piping is leak-checked, evacuated and charged with specified refrigerant.

_____ 3. Additional refrigerant oil added, if required, per circuit.

_____ 4. Piping is properly sized, sloped and trapped for proper oil return.

_____ 5. Piping is routed to reduce potential of rub-through or chaffing.

_____ 6. Hot gas line on Liebert Lee-Temp™ is fastened to the side of the cabinet and isolated for vibration reduction.

6.4 Other

_____ 1. Foreign material removed from in and around all equipment installed (construction materials, construction debris, etc.).

_____ 2. Installation materials and tools have been removed from in and around all equipment (literature, shipping materials, tools, etc.).

_____ 3. Blank startup sheet located, ready for completion by installer or start-up technician.

7 INITIAL STARTUP CHECKS AND COMMISSIONING

WARNING! Arc flash and electric shock hazard. Open all local and remote electric power disconnect switches, verify with a voltmeter that power is Off and wear personal protective equipment per NFPA 70E before working within the electric control enclosure. Failure to comply can cause serious injury or death.

Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power.

The LiebertiCOM® microprocessor does not isolate power from the unit, even in the "Unit Off" mode. Some internal components require and receive power even during the "Unit Off" mode of LiebertiCOM control.

The factory-supplied disconnect switch is inside the unit. The line side of this switch contains live high-voltage.

The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch. Refer to unit electrical schematic.

Follow all local codes.

WARNING! Risk of electric shock. Can cause injury or death.

Open all local and remote unit electric power supply disconnect switches, wait 10 minutes and verify with a voltmeter that power is Off before working within the fan speed control, the EC fan electrical enclosures or checking any electrical connections or functions. Unit contains potentially lethal electrical voltage. Line side of factory disconnect remains energized when disconnect is Off.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning operation.

WARNING! Risk of high-speed, rotating fan blades. Can cause injury or death.

Fan blades can start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Open all local and remote unit electrical power supply disconnect switches, verify with a voltmeter that the power is Off and verify that all fan blades have stopped rotating before working on or near the fans.

7.1 Startup Checklist

Refer to Checklist for Completed Installation on page 83 and verify that all installation items have been completed before beginning to start the condenser.

7.2 Initial Startup

1. Locate *Liebert MC Condensers Warranty Inspection Check Sheet*, Document # PSWI-8542-408CO.
2. Turn the condenser disconnect On.
3. Turn the indoor unit ON and set for cooling to allow operation of condenser.
4. Check the fans for proper rotation: Counterclockwise when viewing the unit from the fan guard (top) side.
5. Check that air is being drawn through the coil and discharged out the fan assembly.
6. Complete *Liebert MC Condensers Warranty Inspection Check Sheet*, Document # PSWI-8542-408CO.

NOTE: This document must be completed and forwarded to your local Vertiv™ sales office to validate warranty.

- Contact your local Vertiv™ sales representative or Vertiv™ Liebert Services support about any questions or problems during unit startup and commissioning.

  Local Vertiv™ sales offices and Liebert Thermal Management support contacts can be found at www.VertivCo.com or by calling 1-800-543-2378.

8 TROUBLESHOOTING

Table 8.1
Troubleshooting

Symptom	Possible Cause	Check or Remedy
Condenser will not start	No power to condenser.	Check voltage at input terminal block.
	Circuit breaker or fuse for low-voltage transformer in condenser is tripped.	Locate problem in condenser electrical panel and repair.
	No low-voltage signal to/from indoor unit.	Locate open circuit and repair.
Low discharge pressure	Faulty head pressure control valve or premium efficiency control board.	Replace if defective.
High discharge pressure	Dirty condenser fins.	Clean coil.
	Condenser fans not operating.	Check for low-voltage signal from indoor unit.
		Check fan motors and fuses.
	High refrigerant charge	Check refrigerant charge.
SPD green and red LEDs are extinguished	No voltage or improper phasing exists at condenser.	Check voltage at input terminal block.
	Electrical connections to SPD are faulty.	Locate connection problem and repair.
	Condenser disconnect is turned Off.	Recheck lights with disconnect switch in the On position.
SPD red LED is illuminated	A surge exceeding the rating of the SPD has occurred.	Replace SPD and inspect other components for damage and replace them if necessary.
Control Board LEDs do not light.	Connection to P24 is loose or disconnected.	Check the connection to P24 to verify that is connected securely.
		Check the connector from the transformer for loose terminals.
	Fuse located next to P24 has blown.	Verify that the fuses next to P24 have not blown. Replace as needed.
	24V transformer has failed.	With a voltmeter verify that the output from the transformer is 24Vac ±10%. If the value exceeds ±10%, verify that the correct primary leads are being used.
	Premium Efficiency Control Board has failed.	If there is no output voltage, verify that the primary connections are secure and receiving the correct voltage. If they are, replace the transformer.
Fan will not run	Jumper not installed between 24V and DIN1 (for Ziehl-Abegg fan motor).	Install jumper between 24V and DIN1 (for Ziehl Abegg fan motor).

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9 CONTROL OPERATION

The Liebert MC Premium Efficiency Control takes approximately 30 seconds to boot up once power is applied to the condenser. The LED on the Premium Efficiency Control Board reads “888” while the board is booting up. Once the control has booted up, the display shows “F00” and then the value for F00. With the control operational, the condenser fan(s) turn in less than 5 seconds after receiving a signal from the indoor unit that the compressor(s) are On. Consider using UPS equipment on both data center cooling units and Liebert MC condensers to maintain uninterrupted cooling capability.

For the first 60 seconds of operation after the compressor turns on, the condenser fan(s) will run at a fixed speed, set at the factory, based on ambient temperature: faster at higher temperatures, slower at lower temperatures. After 60 seconds, the control adjusts the fan speed based on the liquid pressure transducer. If the liquid pressure transducer fails, the condenser uses temperature sensors to control the fan speed based on the liquid line temperature. The condenser fans continue to operate for approximately 30 seconds after compressors turn Off.

The Liebert MC fans have various alarm conditions, such as loss of voltage and loss of control signal, that will stop the condenser fans. Once the alarm condition is no longer present the Liebert MC fans will turn on automatically if compressors are On.

9.1 Premium Efficiency Control Board and Interface

The Liebert MC Premium Efficiency Control board has a stacked board arrangement. There are three seven-segment LED’s and four keys as human machine interface (see Figure 9.2 on page 91).

NOTE: Indicator lights should be On to indicate signal is present. See Figure 9.1 on the next page, #1, 2 and 3.

Figure 9.1 Premium efficiency fan control board

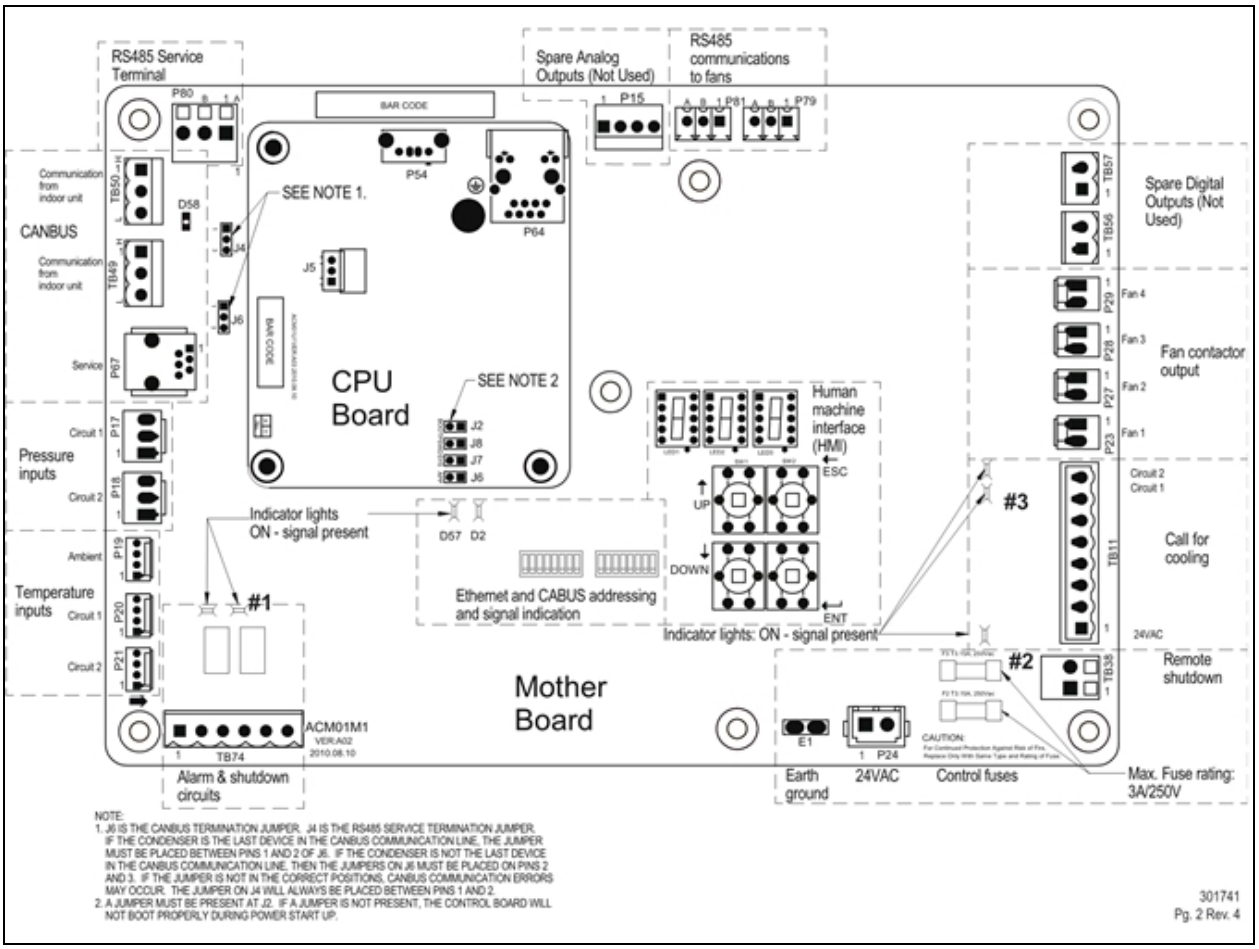
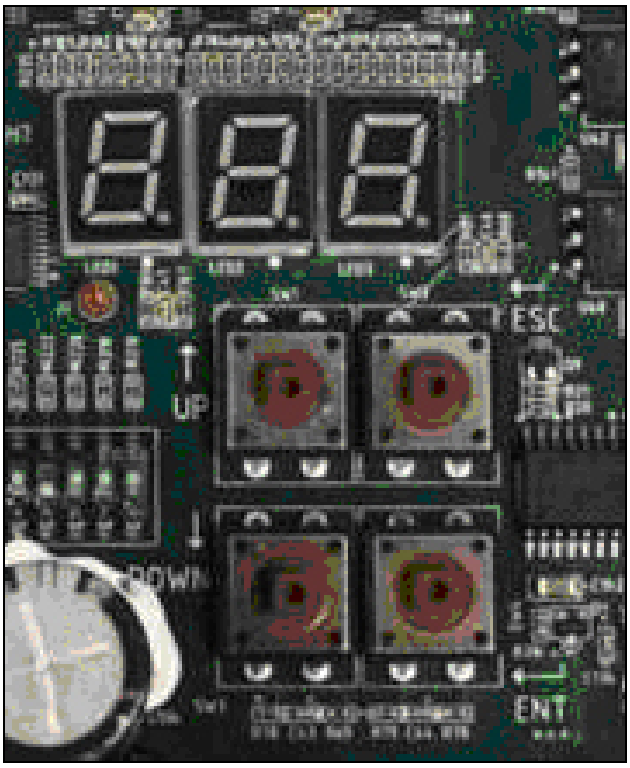


Figure 9.2 Premium Efficiency Control Interface - Human Machine Interface (HMI)

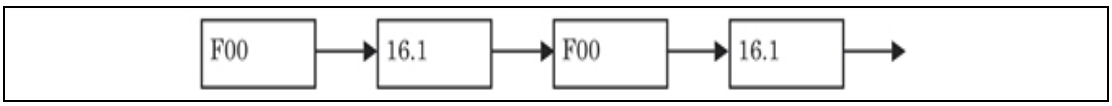


The Premium Efficiency Controls are factory-configured for refrigerant type and whether the condenser was sold with or without a Liebert Lee-Temp™ or Liebert DSE system. No field-configuration is necessary for proper and efficient condenser operation.

9.1.1 Initial Screen Upon Power-On

The controller displays the initial screen after it is powered On. The initial screen shows the first item of analog signals menu. The *F00* and value of condenser pressure *1* are displayed alternatively and *F00* means the item ID of condenser pressure *1*. The display sequence is shown Figure 9.3 below. In the figure, *16.1* is an example and the value is dependent on the sampling result.

Figure 9.3 Initial controller display



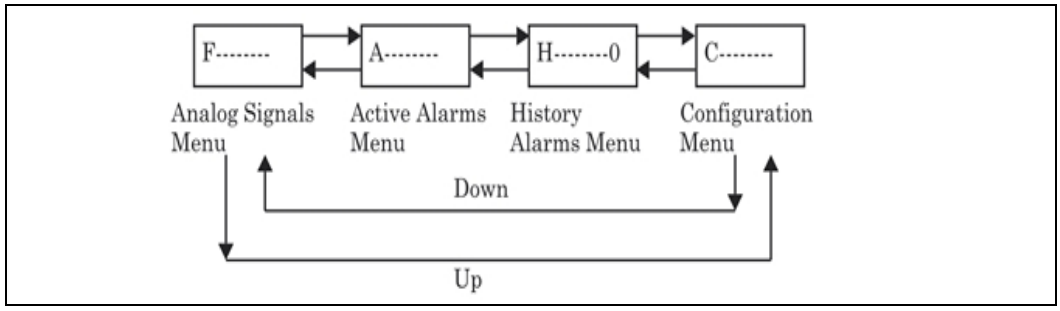
9.1.2 Main Menu Description

In initial screen, presses ESC key, the LED enters the first menu of the main menu. The main menu includes four menus:

- Analog Signals Menu
- Active Alarms Menu
- History Alarms Menu
- Configuration Menu

In the Main Menu, press Up and Down keys to switch to different menus, and press the ENT key to enter the sub menus of the current menu. The operation and structure of main menu are shown in the following figure.

Figure 9.4 Main Menu operation and structure



Notice

Risk of improperly altered configuration menu settings. Can compromise equipment operation.

Changing the configuration menu settings can cause unanticipated results. These settings should be changed only by properly trained and qualified personnel or as directed by the factory.

9.1.3 Analog Signals Menu Description

In analog signals menu F----------, press the ENT key to enter its items. The information of analog signal items includes condenser pressure, temperature and EC Fan actual speed. The display mode is that the item ID and signal value are displayed alternatively. The operation and item structure of analog signals menu are shown in Figure 9.5 below. Table 9.1 on the facing page defines the signals.

Figure 9.5 Analog Signals Menu

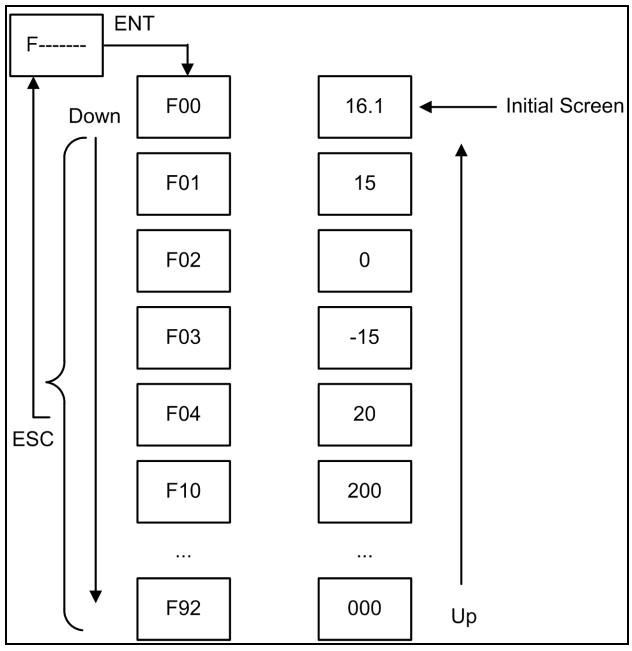


Table 9.1
Analog signal definitions

Item ID	Meaning	Units (C90)	
		Imperial	Metric
F00	Condenser pressure 1	psi	bar
F01	Condenser pressure 2	psi	bar
F02	Ambient temperature	°F	°C
F03	Refrigerant temperature 1	°F	°C
F04	Refrigerant temperature 2	°F	°C
F10	EC Fan 1 actual speed	RPM	RPM
F11	EC Fan 1 requested speed	%	%
F12	EC Fan 1 power	kW	kW
F13	EC Fan 1 firmware version	Hex format	Hex format
F20	EC Fan 2 actual speed	RPM	RPM
F21	EC Fan 2 requested speed	%	%
F22	EC Fan 2 power	kW	kW
F23	EC Fan 2 firmware version	Hex format	Hex format
F30	EC Fan 3 actual speed	RPM	RPM
F31	EC Fan 3 requested speed	%	%
F32	EC Fan 3 power	kW	kW
F33	EC Fan 3 firmware version	Hex format	Hex format
F40	EC Fan 4 actual speed	RPM	RPM
F41	EC Fan 4 requested speed	%	%
F42	EC Fan 4 power	kW	kW
F43	EC Fan 4 firmware version	Hex format	Hex format
F50	Subcooling 1	°F	°C
F51	Subcooling 2	°F	°C
F90	Firmware Version Major		1.02.004
F91	Firmware Version Minor	—	
F92	Firmware Version Build	—	
Source: 303847P1 Rev. 4			

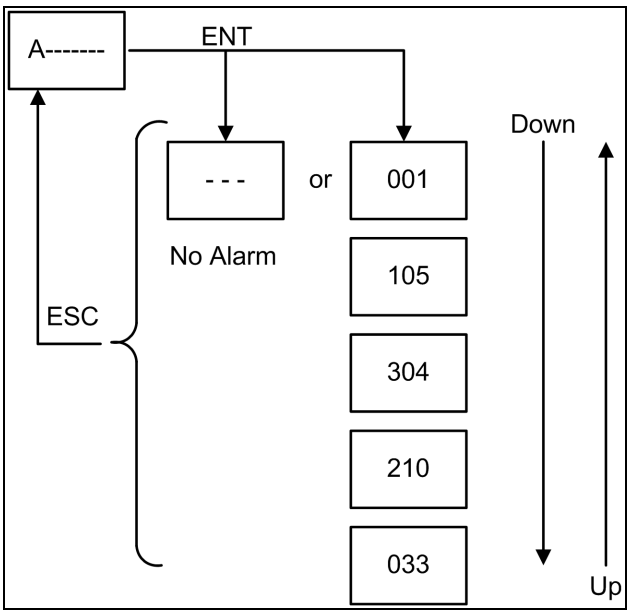
9.2 Premium Efficiency Condenser Alarm Codes

The following procedure and chart details the alarm codes that may be displayed from the Active and History Alarm registers.

9.2.1 Active Alarms Menu Description

In active alarms menu “A——,” press the ENT key to enter its items. The active alarm item displays all the active alarms of condenser. When there is an active alarm, the alarm information ID will be directly displayed. When there is no alarm, “---” is displayed. When there are multiple alarms, the alarm information IDs will be displayed according to the time sequence (the most-recent alarm will be displayed first). The operation and items structure of active alarms menu are shown in the following figure. The meanings of alarm information ID are found in Table 9.2 on the facing page and Table 9.3 on page 96.

Figure 9.6 Active alarms menu



9.2.2 History Alarms Menu Description

In history alarms menu “H——”, press ENT key to enter its items. The history alarm items display 100 history alarm records of the condenser. The item ID is for the sequence number of the history alarms. The display mode is that the item ID and alarm information ID are displayed alternatively. When there is no alarm, “---” is displayed. Alarm history can be cleared using the C98 configuration menu item. The operation and items structure of history alarms menu are shown in the following figure. The meanings of alarm information ID are given in Table 9.2 on the facing page and Table 9.3 on page 96.

Figure 9.7 History alarms menu

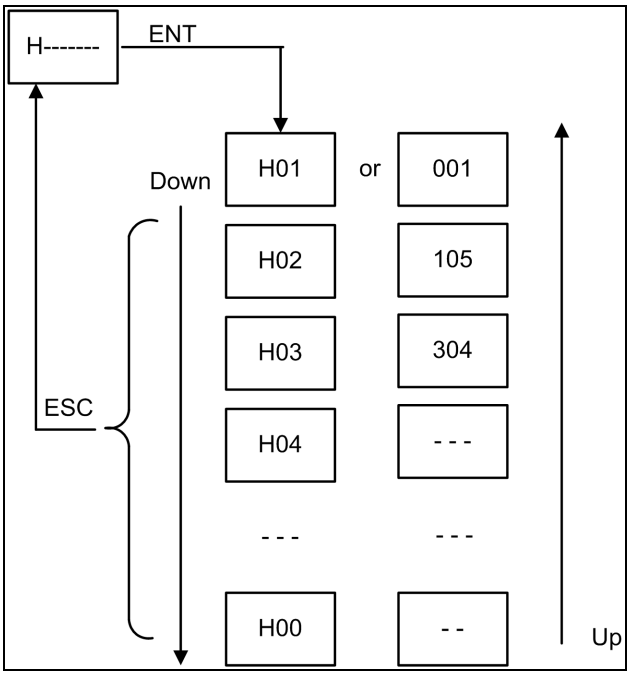


Table 9.2 System alarm information

Alarm ID	Meaning	Possible Cause	Handling Method
000	CAN communication failure	Communication circuit missing or damaged	Check communication circuit. Ignore alarm on condensers without CAN connections
001	Ethernet communication failure	Ethernet hardware or connection failure	Ignore alarm, Ethernet connection is not present
002	USB communication failure	USB device or file is damaged.	Replace USB device or file.
003	Data corruption	Memory chip is damaged	Replace PCB board
004	System error	Internal error	Reboot. If reboot fails, consult factory.
005	Remote shutdown	1. Remote shutdown signal is available 2. TB38 is not connected	For Cause 1, check the remote shutdown signal. For Cause 2, connect TB38.
006	Shutdown due to EC Fan alarm	All fans have failed	Consult factory
007	SPD alarm	SPD damaged	Replace SPD
008	Condenser pressure Sensor 2 failure	Condenser pressure Sensor 1 damaged	Replace condenser pressure Sensor 1
009	Condenser pressure Sensor 2 failure	Condenser pressure Sensor 2 damaged	Replace condenser pressure Sensor 2
010	Condenser pressure 1 high alarm	High pressure: Fan failure, clogged coils. Low pressure: Loss of charge	High-pressure alarms: Fix fan and clean coil. Low-pressure alarms: Check for refrigerant leak.
011	Condenser pressure 2 high alarm		
012	Condenser pressure 1 low alarm		
013	Condenser pressure 2 low alarm		
014	EC Fan speed mode maximum must be overridden due to condenser pressure 1 high	Condenser pressure 1 high	No action is needed.

Table 9.2 System alarm information (continued)

Alarm ID	Meaning	Possible Cause	Handling Method
015	EC Fan speed mode maximum must be overridden due to condenser pressure 2 high	Condenser pressure 2 high	No action is needed.
016	Ambient temperature sensor failure	Ambient temperature sensor damaged	Replace ambient temperature sensor
017	Ambient temperature high alarm	Ambient temperature high	No action is needed.
018	Ambient temperature low alarm	Ambient temperature low	No action is needed.
019	Condenser temperature Sensor 2 failure	Condenser temperature Sensor 2 damaged	Replace condenser temperature Sensor 1
020	Condenser temperature Sensor 2 failure	Condenser temperature Sensor 2 damaged	Replace condenser temperature Sensor 2
021	Condenser temperature 1 high alarm	High temperature: Fan failure, clogged coils. Low temperature: Consult factory	High-temperature alarms: Fix fan and clean coils. Low-temperature alarms: consult factory.
022	Condenser temperature 2 high alarm		
023	Condenser temperature 1 low alarm		
024	Condenser temperature 2 low alarm		
025	EC Fan speed mode maximum must be overridden due to refrigerant temperature 1 high	Refrigerant temperature 1 high	No action is needed.
026	EC Fan speed mode maximum must be overridden due to refrigerant temperature 2 high	Refrigerant temperature 2 high	No action is needed.

Table 9.3 EC Fan alarm information

Alarm ID	Meaning	Possible Cause	Handling Method
(1-4) 00	EC Fan high link current	1. EC Fan is locked. 2. EC Fan is damaged.	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan
(1-4) 01	EC Fan drive error	EC Fan is damaged.	Replace EC Fan
(1-4) 02	EC Fan earth to ground fault	EC Fan is damaged.	Replace EC Fan
(1-4) 03	EC Fan electronics heat sink thermal overload	1. EC Fan is locked. 2. EC Fan is damaged. 3. Ambient temperature is too high	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan For cause 3, check ambient temperature.
(1-4) 04	EC Fan Hall failure	EC Fan is damaged.	Replace EC Fan
(1-4) 05	EC Fan IGBT failure	EC Fan is damaged.	Replace EC Fan
(1-4) 06	EC Fan line fault	Power supply abnormal	Check power supply
(1-4) 07	EC Fan motor locked	Motor is locked	Check if EC Fan is locked.
(1-4) 08	EC Fan motor thermal overload	1. EC Fan is locked. 2. EC Fan is damaged. 3. Ambient temperature is too high	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan For cause 3, check ambient temperature.
(1-4) 09	EC Fan phase failure alarm	Phase failure	Check power supply

Table 9.3 EC Fan alarm information (continued)

Alarm ID	Meaning	Possible Cause	Handling Method
(1-4) 10	EC Fan-specific uncategorized alarm detected	Internal EC Fan issue	Re-boot condenser if fans not running. If alarm persists and fans not running, replace fan.
(1-4) 11	EC Fan-specific uncategorized warning detected		
(1-4) 12	EC Fan electronics high-temperature condition.	1. EC Fan is locked. 2. EC Fan is damaged. 3. Ambient temperature is too high	For cause 1, check if EC Fan is locked. For cause 2, replace EC Fan For cause 3, check ambient temperature.
(1-4) 13	EC Fan high link voltage	1. EC Fan input power supply high voltage 2. EC Fan is damaged.	For cause 1, measure power supply voltage and check if the voltage is normal For cause 2, replace EC Fan
(1-4) 14	EC Fan low link voltage	1. EC Fan input power supply low voltage 2. EC Fan detection error	
(1-4) 15	EC Fan 485 communication failure	1. Communication between EC Fan and PCB board failure 2. EC Fan 485 communication failure 3. Board has problems 4. EC fan not receiving power	For cause 1, check EC Fan communication circuit For cause 2, replace EC Fan For cause 3, replace PCB board For cause 4, check fan model is not set for “0”, check that the contactor for the particular fan is energized, and check fan fuses.

NOTE: (1-4) means the EC Fan addresses. For example, (1-4) 00 means 100 for EC Fan1, and means 200 for EC Fan2, and means 300 for EC Fan3, and means 400 for EC Fan4.

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10 LIEBERT SEISMIC APPLICATION—OPTIONAL UNIT CONFIGURATION

10.1 Seismic Anchoring Considerations

- Mounting requirement details such as anchor brand, type, embedment depth, edge spacing, anchor-to-anchor spacing, concrete strength, special instruction and attachment to non-building structures must be outlined and approved by the engineer of record for the project or building. Structural floors and housekeeping pads must also be seismically designed and approved by the project or building structural engineer of record to withstand the seismic anchor loads defined in Table 10.1 on the next page. The installing contractor is responsible for the proper installation of all anchors and mounting hardware, observing the mounting requirements detailed in the seismic installation drawings as outlined by the engineer of record.
- All braces and fasteners are required to maintain IBC/OSHPD certification of conformity.
- Use a washer, lock washer and screw to connect the brace to the bottom beam of the condenser. (See Figure 10.2 on page 102.)
- Use a washer, lock washer and screw to connect the brace to the condenser leg. (See Figure 10.2 on page 102)
- Place anchorage plate inside each condenser foot of 18-in. legs prior to fastening to the structure. MC condensers with 36-in., 48-in. or 60-in. legs do not require separate anchorage plates for the legs. Use a flat washer, lock washer and nut to connect the condenser to the customer-supplied anchor on the solid surface (reference Detail A in Figure 10.1 on the next page). As a minimum, 3/8" grade anchors with American National Standard Series W, Type A, plain washers (ANSI B18.22.1-1965, R1975) selected to match the nominal anchor diameter must be installed at each anchor location between the anchor head and equipment for tension load distribution.

Figure 10.1 Seismic anchorage data for one-fan models

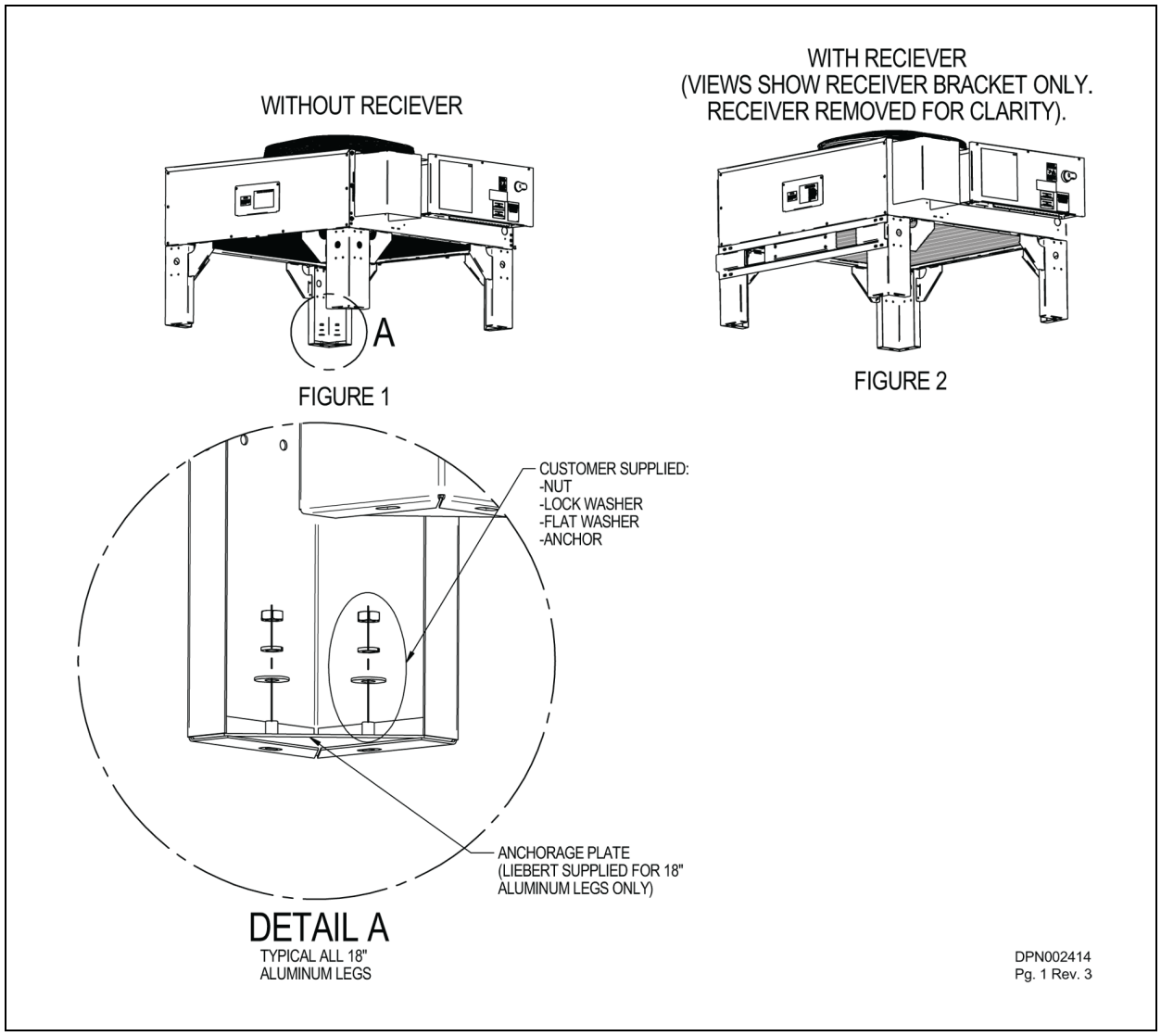


Table 10.1 Seismic anchorage loads for one-fan models

Models	Figure # in Figure 10.1 above	Importance Factor Iρ = 1.0			Importance Factor Iρ = 1.5		
		Maximum Compressive Reaction lb	Maximum Anchor		Maximum Compressive Reaction lb	Maximum Anchor	
			Tensile lb	Shear lb		Tensile lb	Shear lb
MCS028							
Without Receiver	Figure 1	37	14	14	47	24	21
With Receiver	Figure 2	43	15	23	56	27	35
MCM040							

Table 10.1 Seismic anchorage loads for one-fan models (continued)

Models	Figure # in Figure 10.1 above	Importance Factor Iρ = 1.0			Importance Factor Iρ = 1.5		
		Maximum Compressive Reaction lb	Maximum Anchor		Maximum Compressive Reaction lb	Maximum Anchor	
			Tensile lb	Shear lb		Tensile lb	Shear lb
Without Receiver	Figure 1	37	14	14	47	24	21
With Receiver	Figure 2	43	15	23	56	27	35
MCL055							
Without Receiver	Figure 1	37	14	14	47	24	21
With Receiver	Figure 2	43	15	23	56	27	35

* All loads are calculated per ASCE 7-05, Chapter 13.6 Sds = 2.0, Rρ = 6.0, a = 2.5

Source: DPN002414 Rev. 3

Figure 10.2 Seismic anchoring for a two-fan Liebert MC

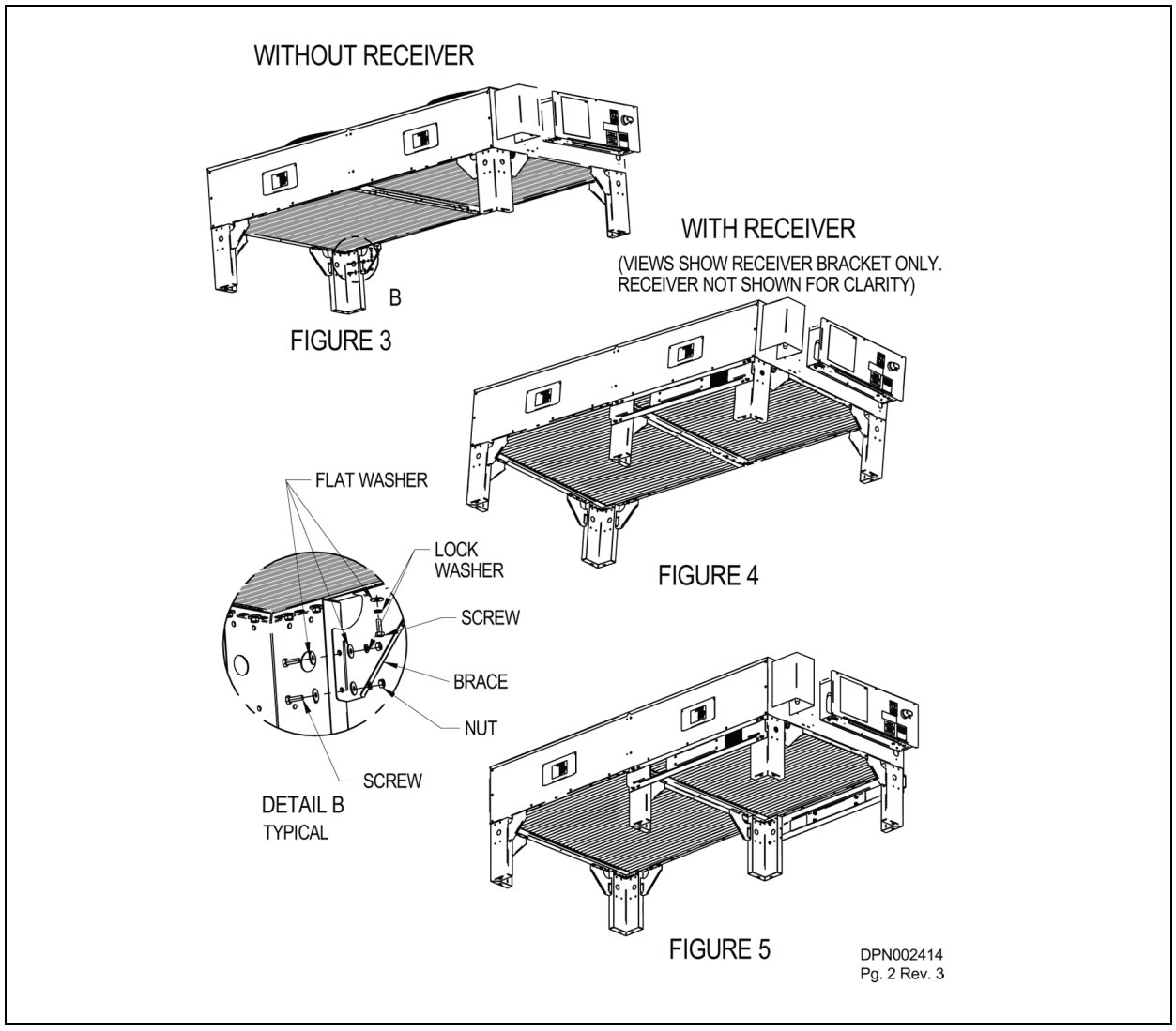


Table 10.2 Seismic anchoring loads for a two-fan Liebert MC

Model #	Figure # in Figure 10.2 above	Importance Factor Iρ = 1.0			Importance Factor Iρ = 1.5		
		Maximum Compressive Reaction lb	Maximum Anchor		Maximum Compressive Reaction lb	Maximum Anchor	
			Tensile lb	Shear lb		Tensile lb	Shear lb
MCS056							
Without Receiver	Figure 3	63	20	23	78	35	34
With Receiver	Figure 5	69	15	30	75	30	45
MCM080							
Single or Dual Circuit without Receivers	Figure 3	94	30	34	116	53	50

Table 10.2 Seismic anchoring loads for a two-fan Liebert MC (continued)

Model #	Figure # in Figure 10.2 above	Importance Factor Iρ = 1.0			Importance Factor Iρ = 1.5		
		Maximum Compressive Reaction lb	Maximum Anchor		Maximum Compressive Reaction lb	Maximum Anchor	
			Tensile lb	Shear lb		Tensile lb	Shear lb
Single Circuit with Receiver	Figure 4	87	34	38	99	59	57
Dual Circuit with Receivers	Figure 5	90	24	38	98	44	57
MCL110							
Single or Dual Circuit without Receivers	Figure 3	146	42	55	179	76	82
Single Circuit with Receiver	Figure 4	131	47	53	158	83	80
Dual Circuit with Receivers	Figure 5	117	31	51	136	59	77
* All loads are calculated per ASCE 7-05, Chapter 13.6 Sds = 2.0, Rρ = 6.0, a = 2.5 Source: DPN002414 Rev. 3							

Figure 10.3 Seismic anchoring loads for a three-fan Liebert MC

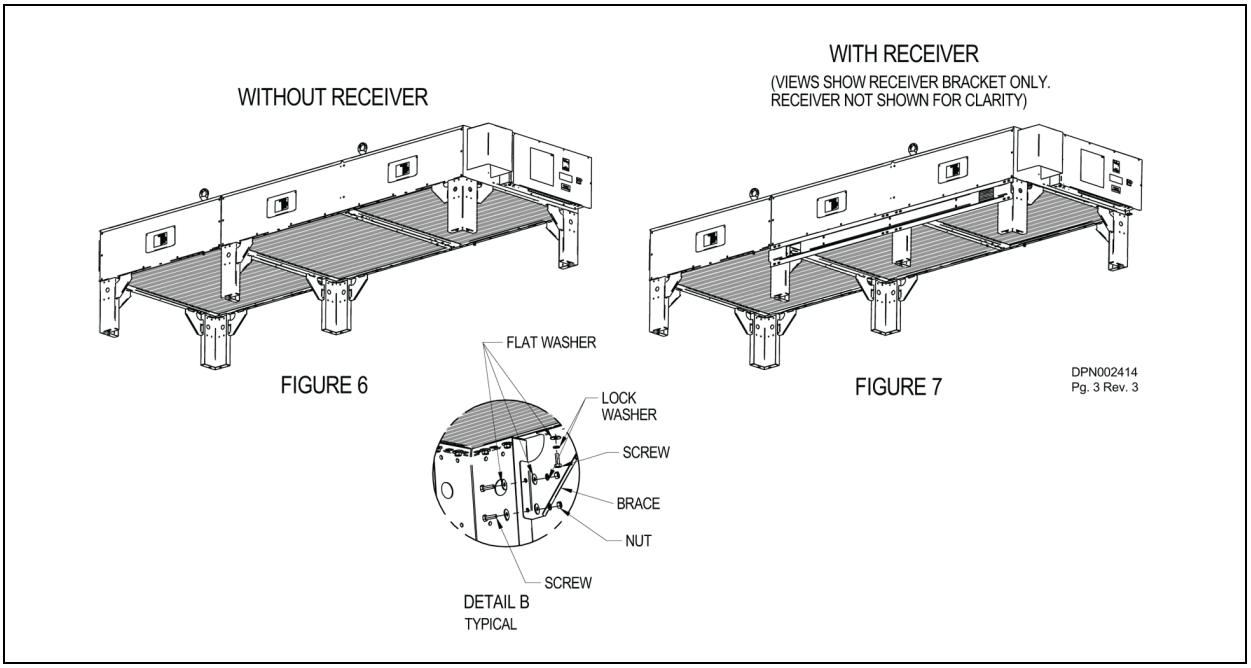


Table 10.3 Seismic anchoring loads for a three-fan Liebert MC

Model #	Figure # in Figure 10.3 on the previous page	Importance Factor I_ρ = 1.0			Importance Factor I_ρ = 1.5		
		Maximum Compressive Reaction lb	Maximum Anchor		Maximum Compressive Reaction lb	Maximum Anchor	
			Tensile lb	Shear lb		Tensile lb	Shear lb
MCL165							
Single Circuit without Receiver	Figure 6	158	39	62	181	73	93
Single Circuit with Receiver	Figure 7	153	38	65	170	73	97
* All loads are calculated per ASCE 7-05, Chapter 13.6 Sds = 2.0, R_ρ = 6.0, a = 2.5 Source: DPN002414 Rev. 3							

Figure 10.4 Seismic anchorage loads for a four-fan Liebert MC

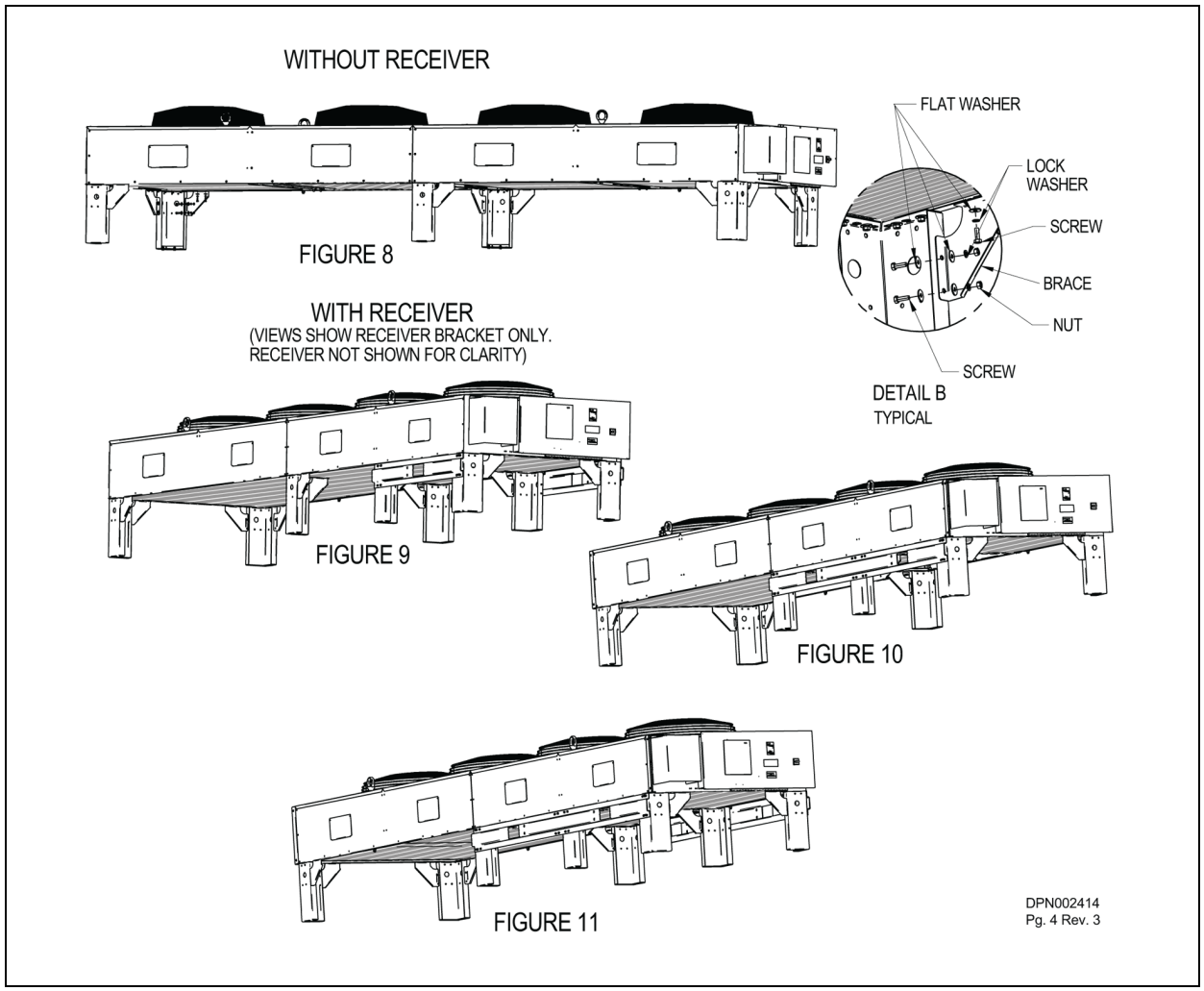


Table 10.4 Seismic anchorage loads for a four-fan Liebert MC

Models	Figure # in Figure 10.4 on the previous page	Importance Factor Iρ = 1.0			Importance Factor Iρ = 1.5		
		Maximum Compressive Reaction lb	Maximum Anchor		Maximum Compressive Reaction lb	Maximum Anchor	
			Tensile lb	Shear lb		Tensile lb	Shear lb
MCM160							
Dual Circuit without Receivers	Figure 8	122	37	42	148	65	62
Dual Circuit with Receivers	Figure 9	120	33	42	145	59	63
MCL220							
Single or Dual Circuit without Receivers	Figure 8	194	53	69	232	95	104
Single Circuit with Receiver	Figure 10	191	51	74	221	92	110
Dual Circuit with Receivers	Figure 11	176	45	60	211	82	90
* All loads are calculated per ASCE 7-05, Chapter 13.6 Sds = 2.0, Rρ = 6.0, a = 2.5 Source: DPN002414 Rev. 3							

Figure 10.5 Seismic anchorage loads for 36-60” extended leg

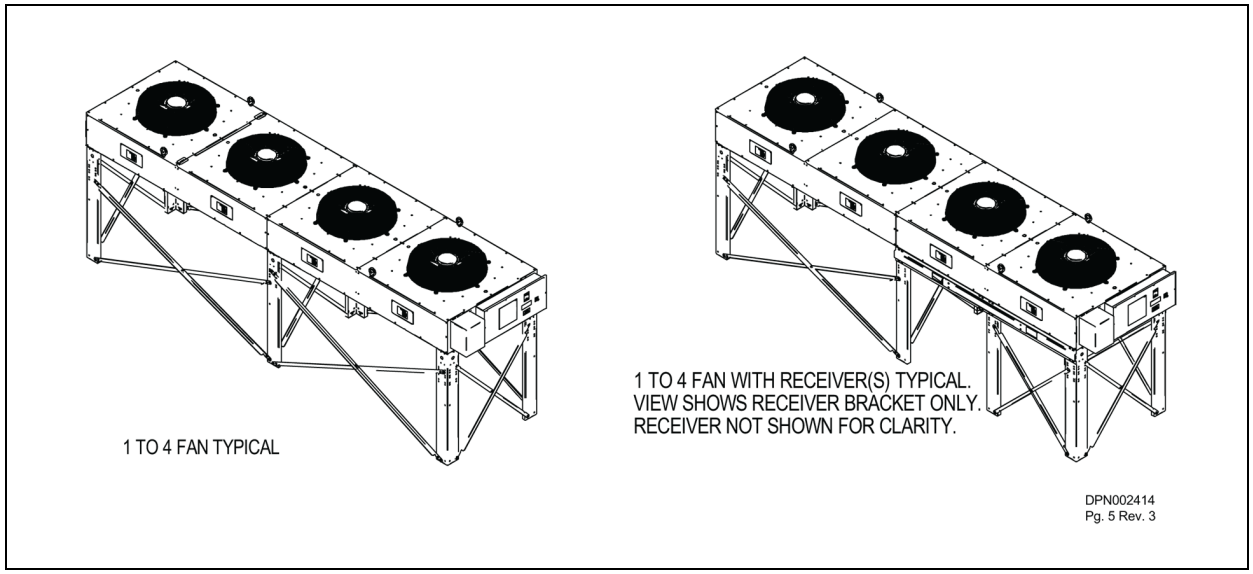


Table 10.5 Seismic anchorage loads for 36-60” extended leg

Models	Importance Factor Iρ = 1.0			Importance Factor Iρ = 1.5		
	Maximum Compressive Reaction lb	Maximum Anchor Loads (ASD)		Maximum Compressive Reaction lb	Maximum Anchor Loads (ASD)	
		Tensile lb	Shear lb		Tensile lb	Shear lb
MCS028 and MCS056						
MCS028 without Receiver	104	42	31	132	70	46
MCS028 with Receiver	110	43	40	141	74	60
MCS056 without Receiver	126	43	40	157	73	61
MCS056 Dual Circuit with Receivers	107	36	44	131	65	66
MCM040 through MCM160						
MCM040 without Receiver	103	39	32	130	66	48
MCM040 with Receiver	114	40	40	144	70	61
MCM080 without Receiver	154	50	51	191	87	77
MCM080 Single Circuit with Receiver	129	56	53	159	96	79
MCM080 Dual Circuit with Receivers	123	40	51	154	73	77
MCM160 Dual Circuit without Receivers	190	60	62	234	104	93
MCM160 Dual Circuit with Receivers	182	54	60	221	94	90
MCL055 through MCL220						
MCL055 without Receiver	165	57	56	207	98	84
MCL055 with Receiver	176	58	64	220	102	95
MCL110 Single or Dual Circuit without Receivers	223	63	80	273	113	119
MCL110 Single Circuit with Receiver	191	70	73	230	122	110
MCL110 Dual Circuit with Receiver	162	47	67	201	87	101
MCL165 Single Circuit without Receiver	201	53	78	235	97	118
MCL165 Single Circuit with Receiver	188	51	79	211	95	118
MCL220 Single or Dual Circuit without Receivers	265	72	93	322	130	140
MCL220 Single Circuit with Receiver	248	68	94	287	124	141
MCL220 Dual Circuit with Receivers	232	61	78	278	109	117

* All loads are calculated per ASCE 7-05, Chapter 13.6 Sds = 2.0, Rρ = 6.0, a = 2.5

Source: DPN002414 Rev. 3

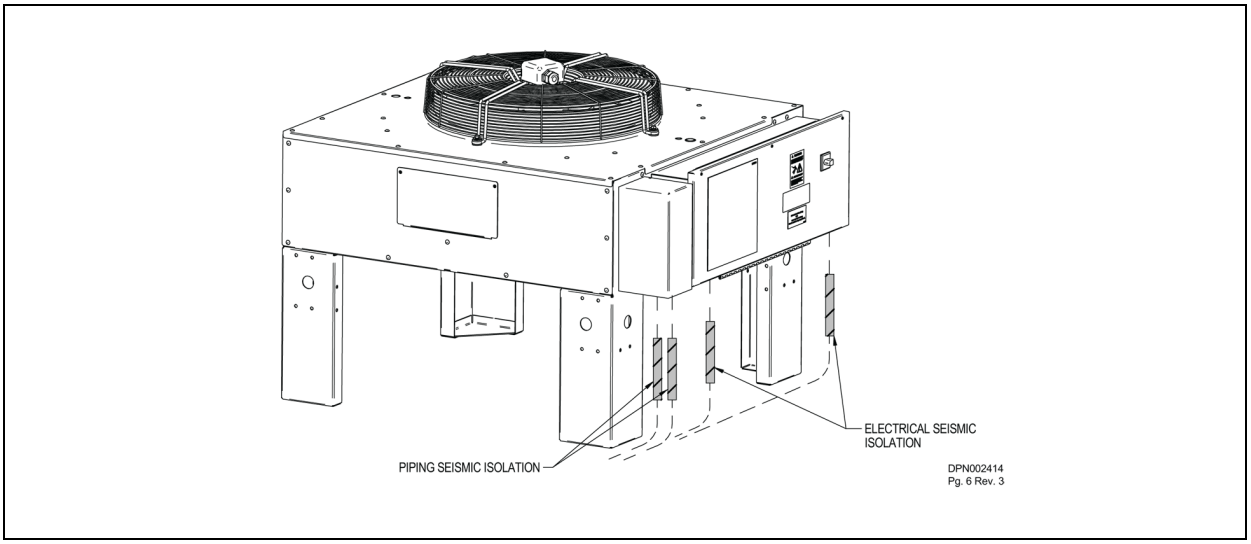
10.2 Seismic piping considerations

Condensers for seismic application must be attached to the piping system with field-supplied, flexible loops designed for seismic movement. Flexible loops must be capable of movement in three dimensions and must isolate the condenser from the field piping. The loops must be suitable for the operating pressure and temperature of the system. Follow manufacturer's installation instructions for proper seismic application of flexible loops. The selection of isolation brand and type must be outlined and approved by the engineer of record for the project or building.

10.3 Seismic wiring considerations

Condensers for seismic application must be connected to power and control circuits using field-supplied flexible conduit and conductors to allow movement of the condenser in three dimensions during a seismic event. The flexible conduit must have at least one bend between the rigid connection at the unit cabinet and the connection to rigid conduit or foundation.

Figure 10.6 Seismic piping and wiring considerations



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11 SYSTEM MAINTENANCE

WARNING! Arc flash and electric shock hazard. Open all local and remote unit electric power disconnect switches, verify with a voltmeter that power is Off and wear protective equipment per NFPA 70E before working within the electric control enclosure. Failure to comply can cause injury or death.

Unit contains potentially lethal voltage in some circuits.

WARNING! Risk of electric shock. Can cause serious injury or death.

Open all local and remote unit electric power disconnect switches, wait 10 minutes and verify with a voltmeter that power is Off before working within the unit electric connection enclosures or working within the fan speed control and the EC fan enclosures. These devices can retain a stored high-voltage electrical charge for up to 10 minutes.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning.

WARNING! Risk of contact with high-speed, rotating fan blades. Can cause serious personal injury or death.

Fan blades can automatically start rotating without warning at any time during a cooling cycle or after power is restored after a power failure. Open all local and remote electric power supply disconnect switches, wait 10 minutes and verify with a voltmeter that power is Off before working within the unit cabinet, removing the fan guards or servicing the fan speed control, fan blades or EC fan motors.

11.1 General Procedures

NOTE: When ordering replacement parts for equipment, it is necessary to specify unit model number, serial number and voltage. Please record those numbers in the spaces below.

- Model Number _____
- Serial Number _____
- Voltage / Phase / Frequency _____

Periodic attention is necessary for continued satisfactory operation of your unit. Restricted air flow through the condenser coil, reduced airflow from non-functioning fans and low refrigerant system charge levels will reduce the operating efficiency of the unit and can result in high condensing temperatures and loss of cooling. In winter, do not permit snow to accumulate around the sides or underneath the condenser coil.

Monthly and semi-annual inspections and maintenance are recommended for proper system operation. Use copies of Preventive Maintenance Checklist on page 123 for each of these inspections.

If performance or operation problem are detected at anytime, refer to Premium Efficiency Condenser Alarm Codes on page 93 for required action.

11.2 Condenser Cleaning

Keeping the outdoor condenser coils clean is an important factor in maintaining peak efficiency, reliability and long life of the equipment. The unit will operate more efficiently with frequent cleanings. Delaying cleaning until heavy buildup occurs may create head pressure problems with the evaporator units.

11.2.1 When to Clean the Condenser Coil

Normal conditions typically dictate cleaning twice a year, spring and fall. On-site or area conditions such as cottonwood trees, construction, etc., can increase cleaning frequency. On your standard monthly preventive maintenance schedule, Vertiv™ recommends a visual inspection of the coil to monitor conditions.

11.2.2 What to Use to Clean the Condenser Coil

The best overall condenser coil cleaner to use is plain water. If the coil has been maintained and cleaned at regular intervals, water is sufficient to remove dirt and debris from the fins. Heavy build up on the exterior of the fins can be removed with a brush. Water pressure from a garden hose and sprayer usually works well. If a pressure washer is used, make sure the equipment is set to a lower pressure setting and that the nozzle is set to the fan spray, not stream. Otherwise, damage to the fins could result. If a cleaner is required, Vertiv™ recommends using a neutral cleaner, neither acidic nor base. Acid-type cleaners can damage the coil fins and surrounding areas. Many sites do not allow the use of acidic cleaners for environmental reasons.

11.2.3 How to Clean the Condenser Coil

The Liebert MC coil is accessible for cleaning through the innovative cleaning window design, allowing you to clean the coil without removing the fans from the unit. First, this requires disconnecting the power supply before working on the unit and then opening the cleaning window(s) on the side of the unit by loosing the mounting screws. Then insert a spray nozzle on the end of a suitable extension and apply the water/cleaning solution, working back and forth across the coil face. The solution will push the dirt and debris out the bottom of the coil. If you are using a cleaner along with the spraying process, follow recommended manufacturer instructions and be sure to rinse the coil thoroughly. Any residue left on the coil can act as a magnet to dirt. Reinstall the cleaning window(s) and reconnect the power supply to the condenser.

Spraying the coil from the outside repeatedly can push a majority of the dirt to the inner section of the fins and continue to restrict air flow. Keep in mind you may not have the luxury of shutting the unit(s) down for an extended time. A scheduled shutdown with the operator may be in order.

Notice

Risk of using damaging cleaning agents, including non-base paint solvents. Can cause equipment damage and damage to property and loss of refrigerant charge.

Using acid-based or sodium hydroxide-based cleaners can damage the Liebert MC condenser coil and cause a loss of charge. This could cause equipment damage as well as damage to the surrounding structure.

NOTE: Clean the EC fan with water only when temperatures are greater than 50°F (10°C).

- Make sure that no water gets into the inside of the motor.

- Do not hold the jet spray directly on the motor openings and seals.

- During cleaning work using a jet spray, no guarantee is assumed regarding corrosion formation/paint adhesion for unpainted/painted fans.

11.3 Fan Replacement

Source: INST-9168, Rev. 3

WARNING! Arc flash and electric shock hazard. Open all local and remote unit electric power disconnect switches, verify with a voltmeter that power is Off and wear protective equipment per NFPA 70E before working within the electric enclosure. Failure to comply can cause injury or death.

Unit contains potentially lethal voltage in some circuits.

Only properly trained and qualified personnel may perform repair, maintenance and cleaning on these units.

WARNING! Risk of electric shock. Can cause serious injury or death.

The fan motor control can contain a residual electric charge after power is disconnected. Do not open the motor electrical-connection enclosure within the first 10 minutes after disconnection of all phases.

WARNING! Risk of contact with high-speed, rotating fan blades. Can cause injury or death.

The fan blades can start rotating without warning any time during a cooling cycle or after power is restored after a power failure. Disconnect all local and remote electrical power supplies to the unit, wait 10 minutes and verify with a voltmeter that the power is Off and that all fan blades have stopped rotating before working on or near the fans.

CAUTION: Risk of contact with hot surfaces. Can cause injury.

Use proper skin protection when touching the electronics housing or allow time for the housing to cool before replacing parts. The electronics housing can get hot and can cause severe burns.

The fan motors and refrigerant discharge lines are extremely hot during unit operation. Allow sufficient time for them to cool before working within the unit cabinet. Use extreme caution and wear protective gloves and arm protection when working on or near fan motors and discharge lines.

CAUTION: Risk of improper moving, lifting and handling of heavy fan modules. Can cause equipment damage or injury.

Only properly trained and qualified personnel should work on this equipment. Fan modules for MCL models weigh in excess of 92lb. (40.8kg) each and fan modules for MCS and MCM models weigh in excess of 40lb. (18.1kg.) each. Use OSHA-approved lifting techniques, proper body mechanics and extreme caution to avoid injury and dropping of fans during removal and installation.

NOTE: If at any time a parameter is entered and the display does not show 888 or if the display shows Err, re-enter the parameter. If the display still shows Err after ENT is pressed, power cycle the control board by unplugging P24, waiting 15 seconds and plugging P24 back in. Contact the factory if the parameter still displays Err after ENT is pressed.

1. Turn Off power to the unit using the disconnect.
2. Use a voltmeter verify that voltage is no longer present at the unit. Wait a minimum of 10 minutes to allow the EC fan capacitors to discharge before proceeding.
3. Remove the fan cover, disconnect electrical connections internal to the EC fan and remove the cable glands from the EC fan to be replaced (see Figure 11.2 on page 119 ,Figure 11.3 on page 119 and Figure 11.1 on page 118).
4. Remove hardware that attaches the EC fan to the condenser.
5. Use lifting equipment or an adequate number of personnel to remove the EC fan from the Liebert MC.

NOTE: A spreader bar may be required for the lifting equipment if only one technician is performing the fan replacement.

6. Install a spreader bar over the new EC fan if only one technician is performing the fan replacement.
7. Verify that the wire harness on the new EC fan is secured out of the way before lifting the fan.
8. Verify that the lifting cable/chains are not coming into contact with fan blades before lifting the new fan into place on the condenser.
9. Install the new fan in the Liebert MC and connect the mounting hardware.
10. Verify that the fan blades rotate freely when installed in unit.
11. Install the new cable glands included with the new EC Fan. Torque for the cable glands is:
    - 630mm and 710mm fans: 19.5 to 24.75 in-lb (2.2 to 2.8 Nm)

- **800mm fans**: 32.75 to 38 in-lb (3.7 to 4.3Nm)

Dispose of the old cable glands once the new glands are installed.

12. Add a compression nut to the wire—Do not tighten the nut.
13. Reconnect the wiring to the proper terminals and verify that the run jumper is in place. Refer to Figure 11.2 on page 119, Figure 11.3 on page 119 and Figure 11.1 on page 118 for wiring details.

    The torque for the electrical terminals is 11.5 in-lb (1.3 Nm). Tighten the compression nut to a torque of 22 in-lb (2.5 Nm).

14. With the PCB powered, the display should read *F00*. Refer to Figure 9.1 on page 90 and Figure 9.2 on page 91.
15. Press the ESC button.
16. Press the Up arrow key once—If *P- -* is displayed, perform step 17; if *P- -* is not displayed, perform steps 18 through 49.
17. If *P- -* is displayed, press the ENT button to enter the P- - Menu.

    The P- - Menu allows for compact setup/preparation of the unit either in the factory or in the field. Use these functions in the table below to establish a default control configuration for the board. Items in the preparation menu are described in Table 11.1 below.

Table 11.1 P-- menu items and definitions

Item ID	Meaning	Default	Notes
P01	Enter Preparation Mode	0	Setting this value to '1' will enable preparation mode. All other 'P—'menu items will be disabled until this value is '1'. Note that control operations may be affected during preparation mode therefore the indoor unit should be off. Setting this value back to '0' will cause the board to create new default values based upon selections in this menu. After default values are established the board will exit preparation mode and reboot.
P02	Automatic VSD Configuration	1	This item should only be used to address the VSDs for the unit. The value entered indicates the model of the VSD: 1 – EBM 2 – Ziehl-Abegg 3 – Fans Tech All fans must be the same model to use this parameter. When *ENT* is pressed, the board will operate and power contactors for the VSDs and assign ModBus addresses. This procedure may take up to 5 minutes to complete.
P03	Refrigerant Type	2	1 = R22 2 = R407C 3 = R410A
P04	Number of Circuits	1	1 = Single Circuit 2 = Dual Circuit
P05	Liebert Lee Temp Option	0	0 = No Lee Temp installed 1 = Liebert Lee-Temp installed
P06	Condenser	1	0 = Small

18. Turn the power On.
19. The control board will flash *F00* on the display when it has completed its boot cycle.
20. Press the ESC button.
21. Use the Up or Down arrow key until *C--* is on the display.

22. Press the ENT button.
23. Use the Up or Down arrow until *C03* is on the display
24. Press the ENT button.
25. Use the Up or Down arrow key to select one of three options.

Configuration Code	Fan #	Value
C03	Fan 1	0 = No Fan 1 = EBM Papst 2 = Ziehl-Abegg
C04	Fan 2	
C05	Fan 3	
C06	Fan 4	

26. Press the ENT button.
27. If the new value was entered into the control board, the display will flash *888*.
28. Press the ESC button for *C03* to show on the display.
29. Repeat steps 20 through 27 for the remaining fans' configuration codes, *C04*, *C05* and *C06*.
30. Unplug all the contactor output plugs except for the fan to be addressed. Plugs are:
    - P23 = Fan 1
    - P27 = Fan 2
    - P28 = Fan 3
    - P29 = Fan 4
31. Wait 30 seconds.
32. Use the Up or Down arrow to select one of the following parameters.

    The correct parameter depends on the supplier of the fan that will be addressed.

    - C00—EBM Papst fan
    - C01—Ziehl-Abegg fan
33. Press the ENT button.
34. Use the Up or Down arrow to the correct fan address number. Fan 1 should be 1 (fan closest to electric panel end). Fan 2 should be 2, etc.
35. Press the ENT button. The display will flash *888* when the command is accepted.
36. Press the ESC button for the parameter to be shown on the display.
37. Repeat steps 30 through 36 for the rest of the fans that need to be addressed.
38. After the last fan is addressed, unplug the power plug, P24, from the control board.
39. Wait 30 seconds.
40. Plug all the contactor output plugs back into the board in their correct positions.
41. Plug P24 back into the control board.
42. Once the control board has completed its boot cycle and all the contactors are energized, wait 5 seconds.
43. Press the ESC button.
44. Use the Up or Down arrow until *A--* is on the display.
45. Press ENT button.
46. Use the Up or Down arrow to see if any of the following errors are shown.
    - 115: Unable to communicate with Fan 1.

- 215: Unable to communicate with Fan 2.
- 315: Unable to communicate with Fan 3.
- 415: Unable to communicate with Fan 4.

47. If any of these errors appear, check the communication wiring at the problem fan and the fan before it.
48. If the wiring is correct and properly wired to the terminal, repeat the fan addressing procedure in steps 30 through 36.
49. If none of the errors in step 46 is displayed, press the ESC button.

11.3.1 Verify the Fan Address

Verify that each fan has a unique address by:

1. Use the Up or Down arrow until *C--* is on the display.
2. Press the ENT button.
3. In the Manual/System Control Selection parameter use the Up or Down arrow until *C24* is on the display.
4. In the Manual Control configuration parameter, press the ENT button.
5. Use the Up or Down arrow to select *0*.
6. Press the ENT button. The display will read *888* if the command was accepted.
7. Press the ESC button for *C24* to show on the display.
8. Use the Up or Down arrow until *C34* is on the display.
9. Press ENT button.
10. If Fan 1 is running, the fans speed should be displayed in terms of percentage of full speed. If Fan 1 is not running, *0.00* should be displayed.
11. Use the Up or Down arrow to enter *100%* speed.
12. Press the ENT button. The display will read *888* if the command was accepted.
    - Fan 1 should speed up to 100%, and all the other fans should stay the same speed.
13. If Fan 1 is not running or if any of the other fans also speed up to 100%, the fan-addressing procedure (steps 30 through 36) must be repeated.
14. Press the ESC button for the parameter to be shown on the display.
15. Repeat steps 3 through 8 for the rest of the fans, if present.
    - C35: for Fan 2.
    - C36: for Fan 3.
    - C37: for Fan 4.
16. All fans should be at 100% speed.
17. Use the Up or Down arrow until *C24* is on the display.
18. Press the ENT button.
19. In the System Control configuration parameter, use the Up or Down arrow to select *1*.
20. Press the ENT button. The display will flash *888* if the command was accepted.
21. Press the ESC button for *C24* to be shown on the display.

All fans should return to a normal speed based on the pressure input and the state of indoor unit's compressor.

Premium Efficiency Control Board Configuration Notes

- J6 is the CANbus termination jumpers. If the condenser is the last device in the CANbus communication line, the jumper must be placed between Pins 1 and 2 of J6. If the condenser is not the last device in the CANbus communication line, then the jumper on J6 must be placed on Pins 2 and 3. CANbus communication errors may occur if the jumpers are not in the correct positions.
- A jumper must be present at J2. If a jumper is not present, the control board will not boot properly during power startup.

Table 11.2 Premium Efficiency Control Board Configuration-parameter List

Sub-menu ID	Meaning	Default R407c		Default R410a		Default R407C W/LT		Default R410a W/LT		Comments
		Metric	Imperial	Metric	Imperial	Metric	Imperial	Metric	Imperial	
C00	EBM address	1		1		1		1		Do not change unless properly instructed.
C01	ZIEHL_ABEGG address	1		1		1		1		
C02	FANS_TECH address	1		1		1		1		
C03	EC Fan 1 model ID	0		0		0		0		
C04	EC Fan 2 model ID	0		0		0		0		
C05	EC Fan 3 model ID	0		0		0		0		
C06	EC Fan 4 model ID	0		0		0		0		
C07	System model ID	0		0		0		0		"0" = Single, "1" = Dual
C09	System refrigerant type	2		3		2		3		"2" = R407c, "3" = R410a
C10	Condenser pressure absolute max 1	18.0 bar	261 psi	28.0 bar	406 psi	18.0 bar	261 psi	28.0 bar	406 psi	R407c - 17-25 bar; 247-362 psi
C11	Condenser pressure absolute max 2	18.0 bar	261 psi	28.0 bar	406 psi	18.0 bar	261 psi	28.0 bar	406 psi	R410a - 25-38 bar; 363-550 psi
C12	Condenser pressure absolute min 1	12.0 bar	174 psi	18.0 bar	261 psi	14.0 bar	203 psi	20.0 bar	290 psi	R407c - 11-17 bar; 160-246 psi
C13	Condenser pressure absolute min 2	12.0 bar	174 psi	18.0 bar	261 psi	14.0 bar	203 psi	20.0 bar	290 psi	R410a - 16-24 bar; 232-347 psi
C14	Condenser pressure PID Kp	1.00		1.00		1.00		1.00		Do not change unless properly instructed.
C15	Condenser pressure PID Kip	0.02		0.02		0.02		0.02		
C16	Condenser pressure PID Kdp	0.00		0.00		0.00		0.00		
C17	Refrigerant temperature max 1	35°C	95.0°F	35°C	95.0°F	35°C	95.0°F	35°C	95.0°F	Range 30 - 40°C; 86 - 104°F
C18	Refrigerant temperature max 2	35°C	95.0°F	35°C	95.0°F	35°C	95.0°F	35°C	95.0°F	

Table 11.2 Premium Efficiency Control Board Configuration-parameter List (continued)

Sub-menu ID	Meaning	Default R407c		Default R410a		Default R407C W/LT		Default R410a W/LT		Comments
		Metric	Imperial	Metric	Imperial	Metric	Imperial	Metric	Imperial	
C19	Refrigerant temperature min 1	25°C	77.0°F	25°C	77.0°F	25°C	77.0°F	25°C	77.0°F	Range 20 - 30°C, 68 - 86°F
C20	Refrigerant temperature min 2	25°C	77.0°F	25°C	77.0°F	25°C	77.0°F	25°C	77.0°F	
C21	Refrigerant temperature PID Kp	0.36		0.36		0.36		0.36		Do not change unless properly instructed.
C22	Refrigerant temperature PID Kip	162.00		162.00		162.00		162.00		
C23	Refrigerant temperature PID Kdp	1.00		1.00		1.00		1.00		
C24	System control state	1		1		1		1		"0" = Manual, "1" = Auto
C25	Condenser pressure setting point 1	14.0 bar	203 psi	20.0 bar	290 psi	16.0 bar	232 psi	22.0 bar	319 psi	R407c - 12-18 bar; 174-261 psi
C26	Condenser pressure setting point 2	14.0 bar	203 psi	20.0 bar	290 psi	16.0 bar	232 psi	22.0 bar	319 psi	R410a - 18-26 bar; 261-376 psi
C27	Lee Temp Option	0		0		0		0		"0" - No Lee Temp installed, "1" - Lee Temp installed
C28	Minimum Speed with LeeTemp	10%		10%		10%		10%		Range 8 - 20%
C32	Refrigerant temp. set point 1	1.67°C	35°F	1.67°C	35°F	1.67°C	35°F	1.67°C	35°F	Range -40 - +40°C; -39.9 - +104°F
C33	Refrigerant temp. set point 2	1.67°C	35°F	1.67°C	35°F	1.67°C	35°F	1.67°C	35°F	
C34	EC Fan1 request speed	0%		0%		0%		0%		Manually sets fan speed (RPM) when C24 is set to "0".
C35	EC Fan2 request speed	0%		0%		0%		0%		
C36	EC Fan3 request speed	0%		0%		0%		0%		
C37	EC Fan4 request speed	0%		0%		0%		0%		
C38	EC Fan Reverse Request			0		0		0		"0" = Off, "1" - On
C39	EC Fan startup speed offset for pressure mode	0		0		0		0		Offset to the startup speed of the EC Fan in range -10% to 10%
C50-C58		Internal system use only!								
C90	Prefered display units.	1		1		1		1		"0" = Metric (bar, °C) "1" = Imperial(psi, °F)
C91	Save configuration to USB flash drive. Pressing ENT will execute the function immediately.									

Table 11.2 Premium Efficiency Control Board Configuration-parameter List (continued)

Sub-menu ID	Meaning	Default R407c		Default R410a		Default R407C W/LT		Default R410a W/LT		Comments
		Metric	Imperial	Metric	Imperial	Metric	Imperial	Metric	Imperial	
C92	Load configuration from USB flash drive. Pressing ENT will execute the function immediately.									
C98	Clear alarm history.									
C99	Restore Factory Defaults except EC fan control parameters									
	Note: Please consult factory before making any changes to the parameter settings. Changing the parameters without proper instructions can lead to poor system performance.									

Figure 11.1 Ziehl-Abegg small, medium and large fan, Liebert MC series MCS, MCM and MCL

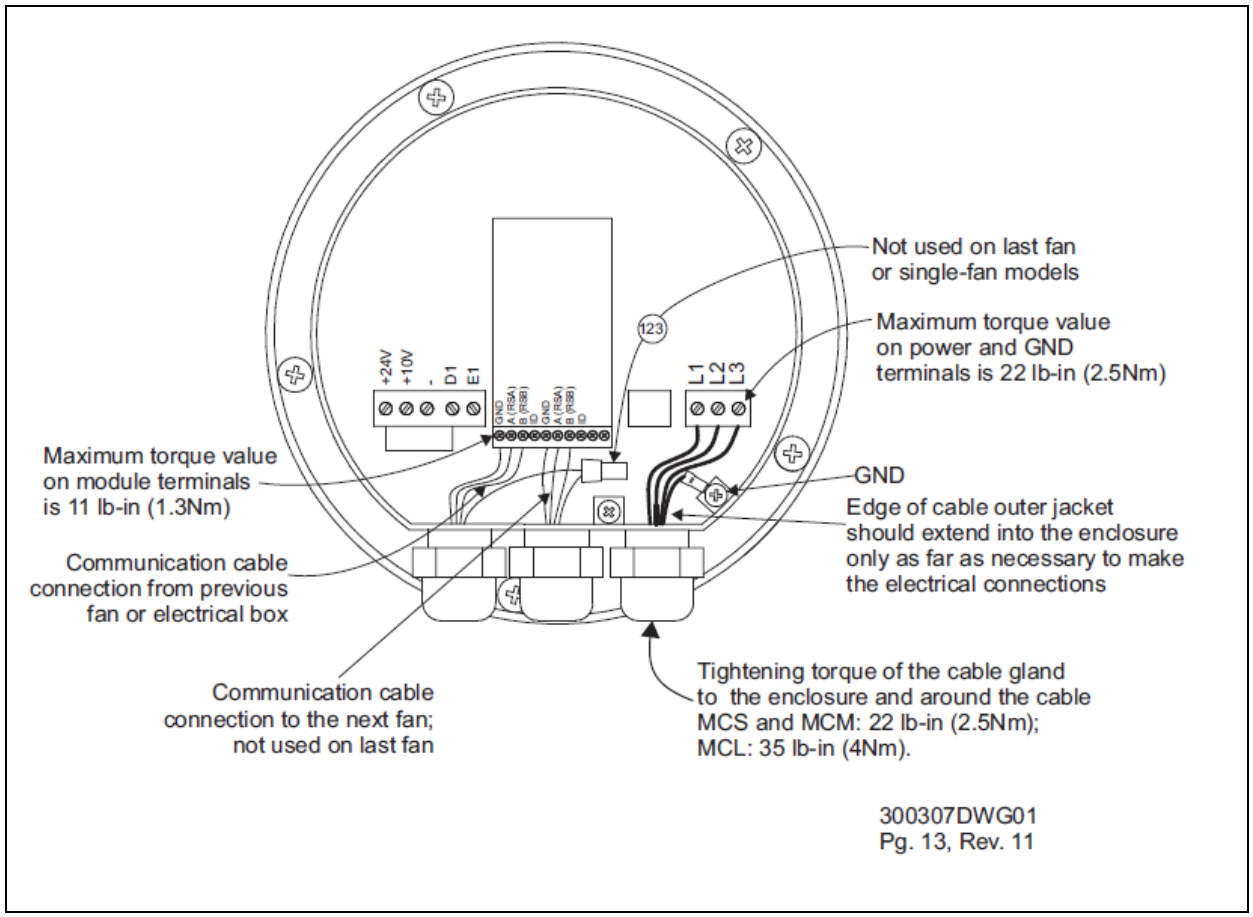


Figure 11.2 EBM small and medium fan, Liebert MC series MCS/MCM

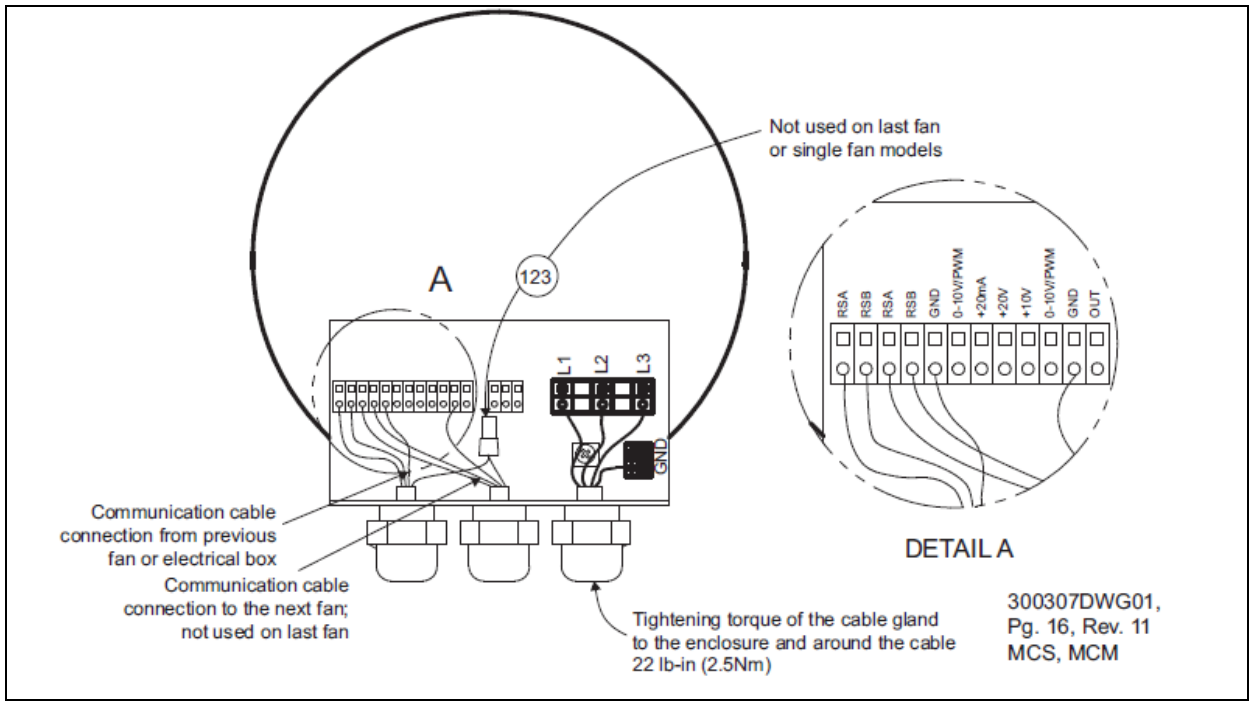
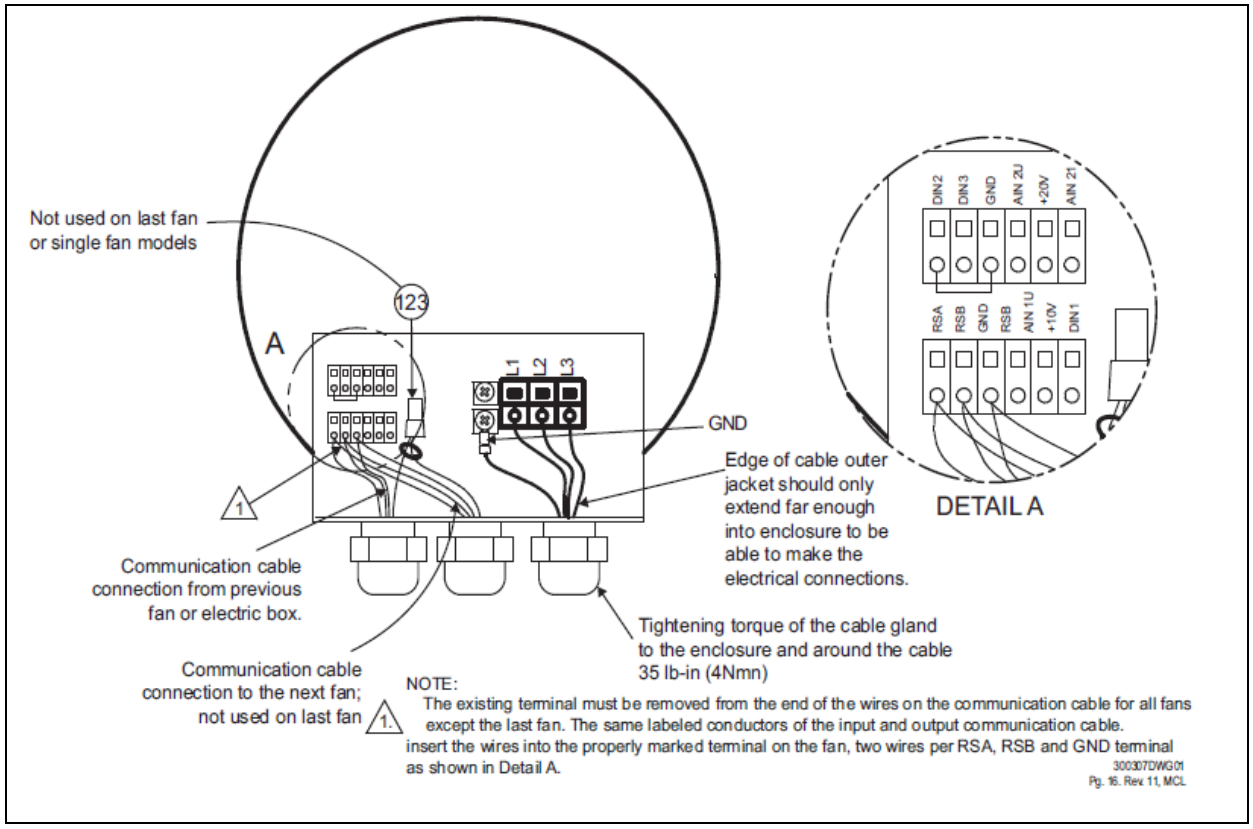


Figure 11.3 EBM large fan—Liebert MC series MCL



11.4 Premium Efficiency Control Board Replacement

WARNING! Arc flash and electric shock hazard. Open all local and remote electric power disconnect switches, verify with a voltmeter that power is Off and wear personal protective equipment per NFPA 70E before working within the electric enclosure.

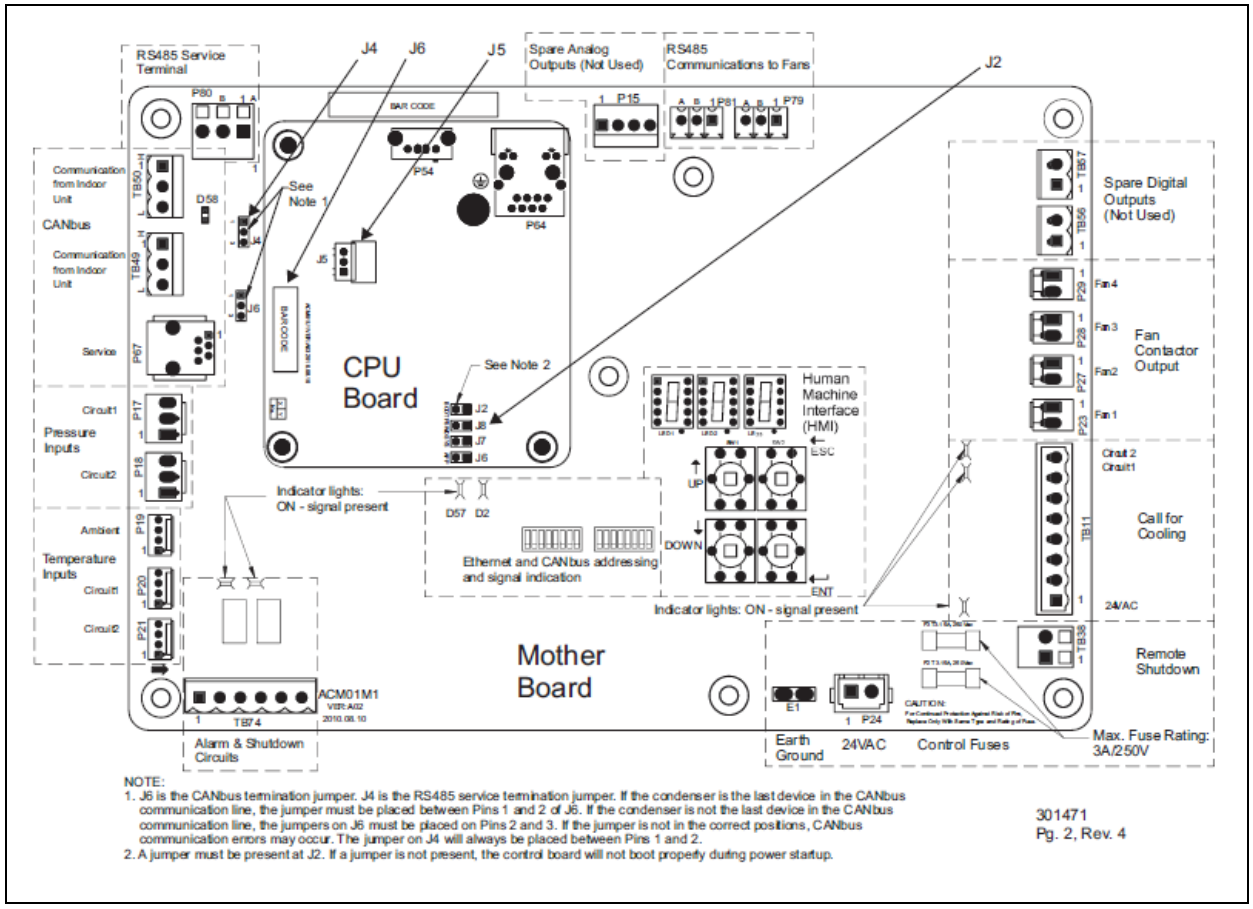
Failure to comply can cause serious injury or death.

This kit should be installed by properly trained and qualified personnel.

11.4.1 Replacement Preparation

1. Verify that the following jumpers are installed on the new board (see Figure 11.4 below):
   - Jumper at J4 and J6 on Pins 2 and 3.
   - Jumper on J2.
   - Jumper on J5 on Pins 1 and 2.
2. Locate the latest revision of the HMI parameters label, 303847P1, included with the new control board.

Figure 11.4 Jumper locations on Control Board



11.4.2 Installation

WARNING! Risk of arc flash and electric shock hazard. Open all local and remote electric power supply disconnect switches, verify with a voltmeter that power is Off and wear appropriate personal protective equipment per NFPA 70E before working within the electric control enclosure or the fan motor connection box(es). Failure to comply can cause serious injury or death.

This unit contains lethal voltage. The line side of the unit disconnect switch remains energized when the unit disconnect switch is in the "Off" position. Use a voltmeter to verify that the line side input electric power to the unit disconnect switch is Off before working on any electrical components or connections.

1. Turn Off the disconnect switch on the enclosure cover.
2. Open the control enclosure cover.
3. Manually turn On the disconnect switch. Power is On and a shock hazard exists with exposure to hazardous voltage components.
4. If the board can still be powered up and has a display, record the parameter settings. To obtain parameters go to the *C--* menu and press the Up or Down button to read and record the values for C03-09 and C27.
5. Record all of the DIP switch positions for the CANbus DIP switch package. Retain these for setting up the new board.
6. Record the positions of the jumpers for J2, J4, J5 and J6 on control board in the unit. Retain these for setting up the new board.
7. Disconnect power from the Liebert MC by turning Off the main disconnect switch.
8. Use a voltmeter to verify that voltage is no longer present in the unit.
9. Remove the plugs and field-installed wires from the old board. Note the polarity for the CANbus wiring going to P49 and P50, if present.
10. Mark wires P49-1, P49-3, etc, if they are not already marked.
11. Remove the mechanical fasteners holding the control board in place and remove the old control board.
12. Install the new control board using the fasteners removed in step 11.
13. Reattach the plugs. Refer to the hot-stamps on the wire harnesses that correspond to the correct plug on the board. Verify that the plugs are installed properly.
14. Change the CANbus DIP switch positions so they match the control board that was removed. If the Liebert MC is the second condenser on the CANbus communication line, set Position 1 of the CANbus DIP switch from On to Off.
15. Change the jumper positions for J2, J4, J5 and J6 to match the control board that was removed. If the Liebert MC is the last device on the CANbus communication line, move the jumper at J6 from Pins 2 and 3 to Pins 1 and 2 (see Figure 11.4 on the previous page).
16. Power up the unit.
17. Change the parameters to match the parameters from the control board that was removed if they were obtained from the old board in step 4. See step 18 if the parameters were unavailable.

18. If the old board parameters were unavailable, use the new HMI label included in kit to obtain the proper settings. Parameters C03, C04, C05 and C06 must be programmed with the proper EC fan supplier used on the unit.
19. Address the fans (refer to Fan Replacement on page 111).
20. Compare the HMI label on the unit with the latest revision.
    - If there are differences, clean and dry the surface of the old HMI label; attach the new label on top of the old label, covering the old label with the new one.
21. Verify that the control board is reading pressure and temperature.
22. Verify that there are no communication alarms with the fans or with the cooling unit the Liebert MC is serving.
23. Verify proper fan operation by adjusting the cooling unit that this condenser serves so that it calls for cooling.

12 PREVENTIVE MAINTENANCE CHECKLIST

Source: DPN003119, Rev. 0

MC Preventive Maintenance Worksheet

Inspection Date	_____	Job Name	_____
Indoor Unit Model #	_____	Indoor Unit Serial Number #	_____
Condenser/Drycooler Model #	_____	Condenser/Drycooler Serial #	_____
Room Temperature/Humidity	°___ %___	Ambient Temperature	°_____

Good maintenance practices are essential to minimizing operation cost and maximizing product life. Read and follow all applicable maintenance checks listed below. At a minimum, these checks should be performed semi-annually. However, maintenance intervals may need to be more frequent based on site-specific conditions. Review the unit user manual for further information on unit operation. Vertiv™ recommends the use of trained and authorized service personnel, extended service contracts, and factory-certified replacement parts. Contact your local Vertiv™ Representative for more details.

Check all that apply:

Air-Cooled Fin-and-Tube Condenser/Drycooler (if equipped)

_____ 1. Coil clean free of debris

_____ 2. Motor mounts tight

_____ 3. Piping support/clamps secure

_____ 4. Check/Re-torque wire connections

_____ 5. Check contactors for pitting (replace if pitted)

_____ 6. Check fuses

_____ 7. Verify fan operation

_____ 8. Check surge-protection device status-indicator lights (if equipped)

_____ 9. Ambient thermostat settings _____ _____ _____ _____

_____ 10. Refrigerant level (Lee-Temp™)

_____ 11. Glycol level

_____ 12. Glycol solution ----_____%

_____ 13. Water/Glycol solution flowing continuously/clean and free of debris

_____ 14. Water-treatment plan established and followed for open cooling-tower application

_____ 15. Check refrigerant/glycol lines for signs of leaks/repair as found

_____ 16. Motor amp draw

#1	L1	_____	L2	_____	L3	_____
#2	L1	_____	L2	_____	L3	_____
#3	L1	_____	L2	_____	L3	_____

#4	L1	_____	L2	_____	L3	_____
#5	L1	_____	L2	_____	L3	_____
#6	L1	_____	L2	_____	L3	_____
#7	L1	_____	L2	_____	L3	_____
#8	L1	_____	L2	_____	L3	_____

Glycol Pump (if equipped)

_____ 1. Check pump rotation

_____ 2. Check for glycol leaks

_____ 3. Pump pressures

#1	Suction	_____	Discharge	_____
#2	Suction	_____	Discharge	_____
#3	Suction	_____	Discharge	_____

_____ 4. Amp Draw

#1	L1	_____	L2	_____	L3	_____
#2	L1	_____	L2	_____	L3	_____
#3	L1	_____	L2	_____	L3	_____

_____ 5. Verify pump changeover (if multiple pumps)

Liebert MC Condenser (if equipped)

_____ 1. Coil clean

_____ 2. Fans free of debris

_____ 3. Fans securely mounted

_____ 4. Motor bearings in good condition

_____ 5. Check all refrigerant lines for vibration isolation. Support as necessary

_____ 6. Check for refrigerant leaks

_____ 7. Check surge-protection device (if installed) status-indicator lights

_____ 8. Check/Re-torque wire connections

_____ 9. Check contactors for pitting (replace if pitted)

_____ 10. Verify operation sequence/set points

_____ 11. Charge verification:

_____ a. Outdoor Ambient Temperature ------_____

_____ b. Subcooling ------_____

_____ c. Indoor-unit Return-air Temperature ------_____

_____ d. Sight-glass level (if Lee-Temp or pumped refrigerant) ------_____

_____ 12. Motor amp draw

#1	L1	_____	L2	_____	L3	_____
(L1 and L2 on Fan Speed Control Motor)						
#2	L1	_____	L2	_____	L3	_____
#3	L1	_____	L2	_____	L3	_____
#4	L1	_____	L2	_____	L3	_____
#5	L1	_____	L2	_____	L3	_____
#6	L1	_____	L2	_____	L3	_____
#7	L1	_____	L2	_____	L3	_____
#8	L1	_____	L2	_____	L3	_____

Liebert EconoPhase Pumped-refrigerant Economizer (if equipped)

_____ 1. Check for refrigerant leaks

_____ 2. Check/Re-torque wire connections

_____ 3. Check contactors for pitting (replace if pitted)

_____ 4. Verify pump-speed control operation

_____ 5. Check pump mounting

Maintenance Notes

Name
Signature
Company
Make photocopies for your records. Compare readings/information to previous maintenance worksheet. To locate your local Liebert representative for Liebert engineered parts, check the Liebert Web site : *www.liebert.com* or call 1-800-LIEBERT.

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SL-19536_REV6_10-17/590-1689-501A